

LARGE - SCALE SYSTEM USER REQUIREMENTS

INPUT

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Planning Services for Management

LARGE-SCALE SYSTEM
USER REQUIREMENTS

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I INTRODUCTION

I INTRODUCTION

- This report is produced by INPUT as part of the 1983 Field Service Program for the United States, for clients of that program.
- The principal driving force behind field service management decisions on packaging and pricing maintenance services (both hardware and software) should be users' requirements for such services and their level of satisfaction with current services.
- New issues, such as using field engineers in a sales role and customer involvement in the maintenance process, should also be critically reviewed in the light of what the users have to say about them.
- For this reason, INPUT has scheduled the user requirements series of reports as the first deliverables of the program.
- Each report concentrates on one area of the market. This report is addressed only to the large system user. In addition, each vendor is treated separately so each may review data from their own users and make comparisons with competitors.

A. DEMOGRAPHICS

- A total of 324 user interviews were accomplished as indicated in Exhibit I-1 (by vendor) and Exhibit I-2 (by industry sector). The title of the person interviewed was as follows:

Vice-President/Assistant Vice-President	11
Director/Assistant Director	51
Manager/Assistant Manager	208
Supervisor	24
Systems Administrator	1
Systems Analyst	<u>29</u>
	324

B. METHODOLOGY

- The basis for the interview was the questionnaire shown in Appendix B. The data obtained was entered on dBASE II's relational data base management system and analyzed using ABSTAT. The resulting printouts were summarized to produce the exhibits that are part of this report.
- As with all reports, the data selections were arbitrary. However, since each client receives a copy of the raw data (and the corresponding dBASE file structure) on a floppy disk, each client may analyze and cross tabularize the data as they see fit.
- The data base file formats, description and methodology for screening them are contained in Appendix A and associated Exhibits A-1, A-2, A-3, and A-4.

EXHIBIT I-1

INTERVIEW SAMPLE BY VENDOR

VENDOR	LARGE SYSTEM USERS INTERVIEWED	MAIN PRODUCTS SURVEYED
IBM	53	(26 43XX; 15 303X; 12 308X)
Amdahl	34	(33470 Series; 1 58XX)
Honeywell	33	(16 DPS 8; 14 66DPS; 68DPS; 3 DPS 7)
Univac	31	(9 90/60; 12 90/80; 9 1100/80; 90/70)
DEC	30	(9 DEC 10; 10 DEC 20; 10 VAX 11/70)
NAS	30	(15 AS/5000; 12 AS/7000; 3 AS/9000)
Burroughs	28	(11 B5900; 15 B6900; 2B6800)
CDC	24	(9 OMEGA 480; 14 CYBER 170/700)
Data General	21	(8 MV/6000; 13 MV/8000)
Perkin-Elmer	20	(14 32XX; 3 7/32 3 8/32)
Cray	10	(all CRAY-1)
Tandem	10	(all NONSTOP I)
Total	324	

EXHIBIT I-2

LARGE-SYSTEM USER SAMPLE BY INDUSTRY SECTOR

SECTOR	USER INTERVIEWS
Process Manufacturing	44
Discrete Manufacturing	27
Transportation	11
Utilities	26
Banking and Finance	21
Insurance	13
Medical	14
Education	59
Retail	7
Wholesale	12
Federal Government	9
State and Local Government	31
Services	47
Other	3
Total	324

- Client comments on the usefulness of this data structure are welcomed, particularly in the light of how INPUT can make the transfer of data to client computers as easy and efficient as possible.

C. USERS INTERVIEWED

- The individual user responses are confidential with respect to their identities. However, the anonymous responses have been provided to clients (raw data printouts), and the list of the companies interviewed (without the associated responses) are provided in Appendix C.

II EXECUTIVE SUMMARY

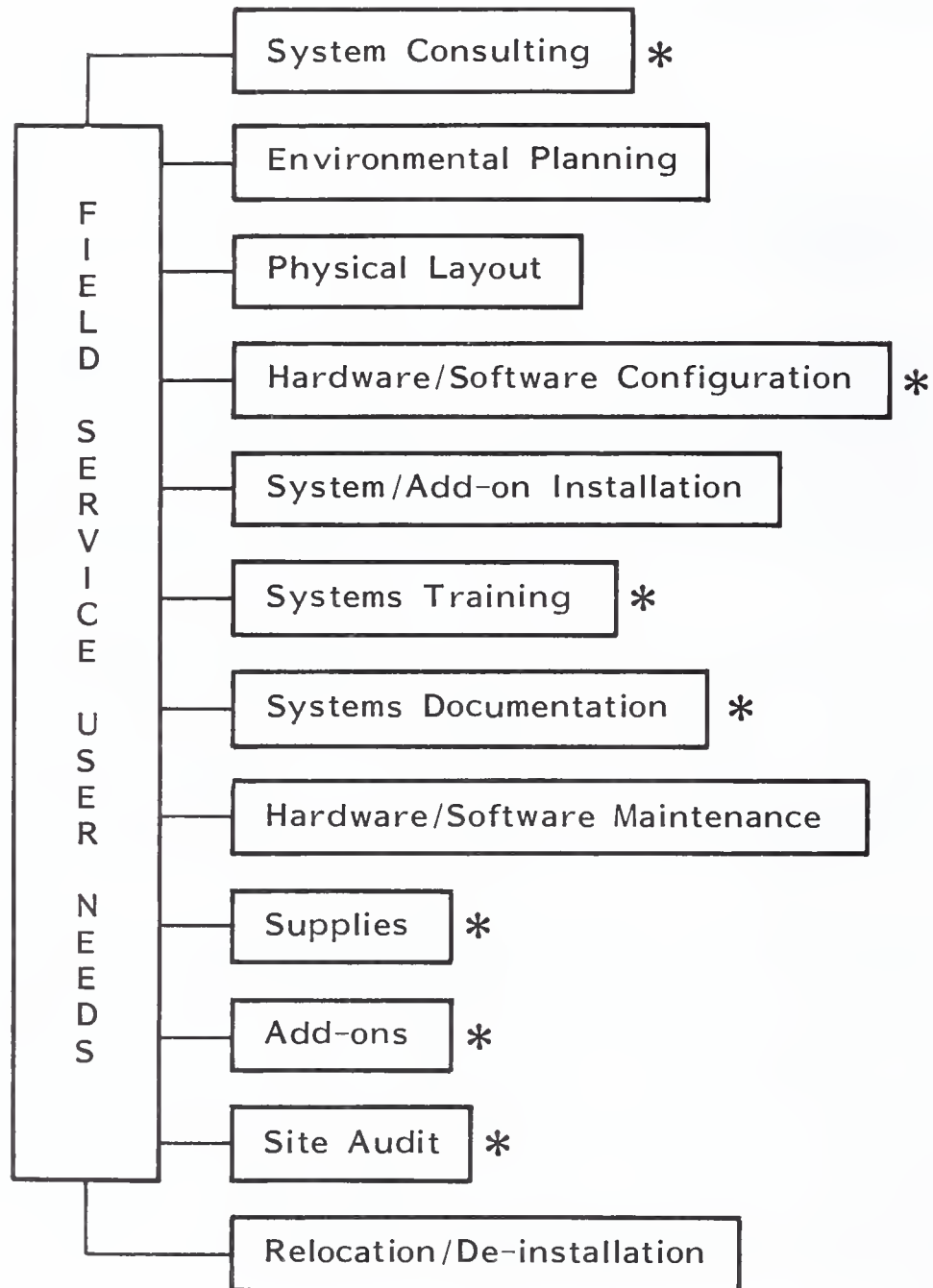
II EXECUTIVE SUMMARY

A. TOTAL SERVICE CONCEPT

- Service organizations that were originally organized and staffed for hardware maintenance have, for the most part, made the difficult transition to include software maintenance in the services provided. (This is not to say that both services are equally understood by field service management.)
- This was a necessary move created by the need for a single source of system service for the end user, but the need does not stop there. A whole host of services, some minor, some major, are an integral part of the role of the field service engineer. INPUT refers to this as the total service concept.
- The user requirements for each of the components of total service were researched in the first quarter reports and are analyzed in Chapter III of this report for large-system users. These needs are more evident at the large-system end of the product spectrum than they are elsewhere, but many of the functions which should be part of the field service organization's roles are often placed elsewhere (usually in sales support). These components are schematically shown in Exhibit II-1.
- The rationale behind the inclusion or exclusion of a function in this broader definition of the role of field service is the need to concentrate the energies of each corporate group on a homogeneous task; e.g., it makes no sense to

EXHIBIT II-1

COMPONENTS OF FIELD SERVICE



* Usually not part of today's Field Service

make salesmen handle supply sales or add-on sales when the field engineer has regular contact with the DP manager and can accommodate these needs as a by-product of his regular duties.

- This brings the definition of the role of field service closer to after sales support (as exemplified by many FS organizations that call themselves customer services).

B. AFTER-SALES SUPPORT COMPONENTS

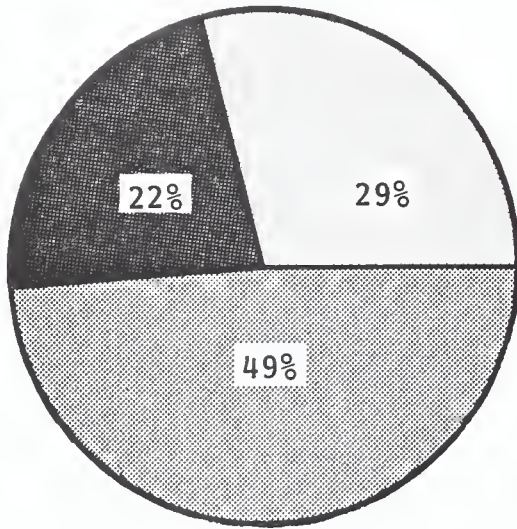
- The items listed in Exhibit II-1 may appear to over-extend the responsibility of the field service organization, but in reality they are the logical outcome of user requirements and attitudes. All of the following are recommended and discrete field service activities:
 - System Consulting - An after-sales activity that aims at integrating site configuration growth with the user application implementation plans. Field engineers usually have the status of systems consultant in the eyes of the user; this activity merely sanctions that status on a fee-paying basis.
 - Environmental Planning - Monitors the quality of the environment of the locations in which equipment is installed. Many vendors delegate this task to outside third-party companies.
 - Physical Layout - Normally a (free) part of service activities.
 - Hardware/Software Configuration - Usually accomplished initially (inconsistently) by the sales and sales-support staff, with the main pre-occupation being to minimize sales price. The ongoing development of the configuration, particularly with a view to the hardware implications of software additions, is a service best rendered by field service.

- System and Add-on Installation - Already a part of field service.
- Systems Training - Ongoing training on hardware and software usage (as opposed to the initial training provided by sales support). In particular, on-going software training should aim at eliminating the 60% of maintenance calls that are caused by user misuse or lack of understanding.
- Systems Documentation - Both hardware and software. An integral part of systems training.
- Hardware/Software Maintenance - The core business of all field service organizations.
- Supplies - Still frequently excluded from field service operations for unexplained reasons.
- Add-ons - Still the domain of sales, mainly because sales representatives view this as a captive source of revenue for commission generation. (This set-up has more to do with the design of commission plans than with logic.)
- Site Audit - Frequently completely absent from the list of vendor services, despite the excellent side benefits in customer satisfaction, service image, and field data gathering.
- Relocation/De-installation - Usually part of field services.

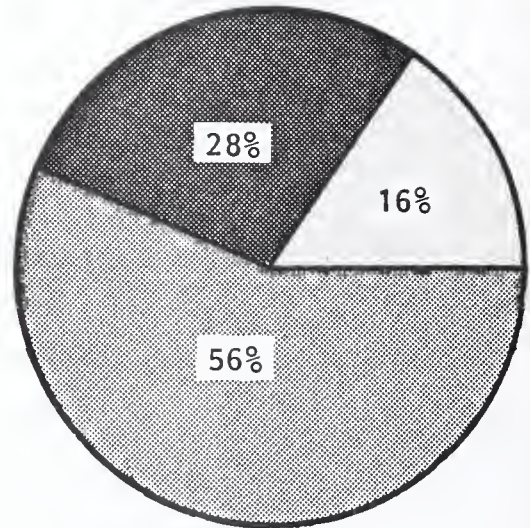
C. REQUIREMENTS VERSUS CURRENT SERVICE

- Most field service operations still measure themselves according to their own criteria. If their service contracts call for them to respond in one hour, two hours, or four hours, and they meet this requirement 95% of the time, then they will believe that they are performing well.
- If users are allowed to voice their own opinions, the picture changes:
 - By their own criteria, users judge large and medium mainframe vendor hardware maintenance to be mainly unsatisfactory, as shown in Exhibit II-2.
 - In many cases, vendors do not pay attention to the particular needs of each user; the result is that, while many users go unsatisfied, items will receive a higher level of service than they need (overkill).
 - In other instances, most users experience overkill while few are dissatisfied - a clear case of needless effort and expense.
- The user community is hard to please, and the perfect score should not be sought, but large imbalances should and must be corrected. In many cases, apparent service improvement needs merely translate into the judicious application of existing labor, raising overall user base satisfaction at no extra cost.
- Overall, mainframe users acquire improvements in hardware maintenance, software maintenance, add-on sales, supplies sales, training, and documentation. They are largely satisfied with current service in environmental planning, site planning, installation planning, consulting, relocation/de-installation, and site audit. Results are shown in Exhibit II-3.

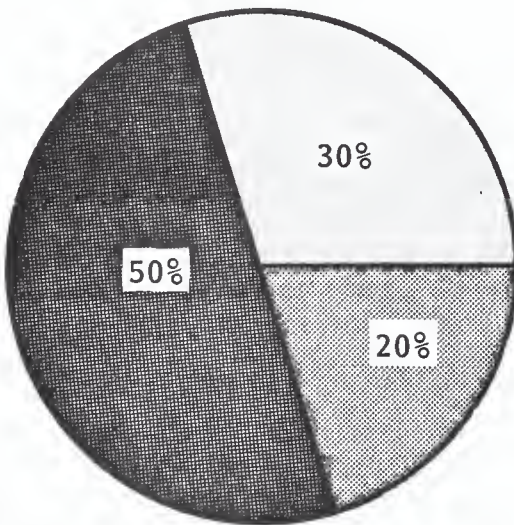
EXHIBIT II-2
USER REQUIREMENTS VERSUS SERVICE RECEIVED
(Principal Services)



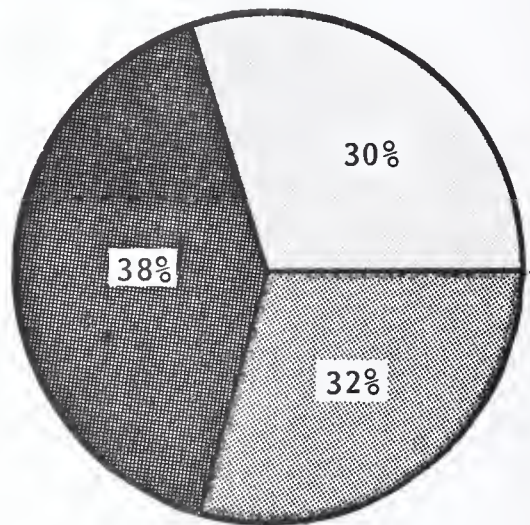
Hardware Maintenance



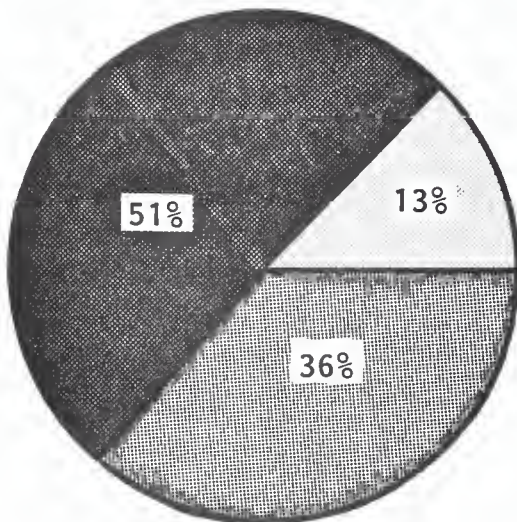
Software Maintenance



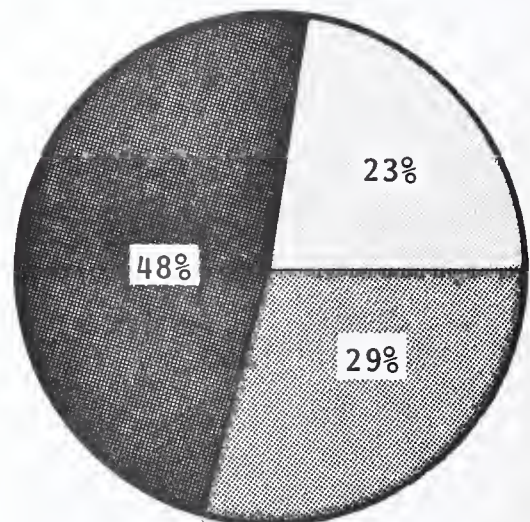
Relocation/De-installation



Add-on Sales



Supplies Sales

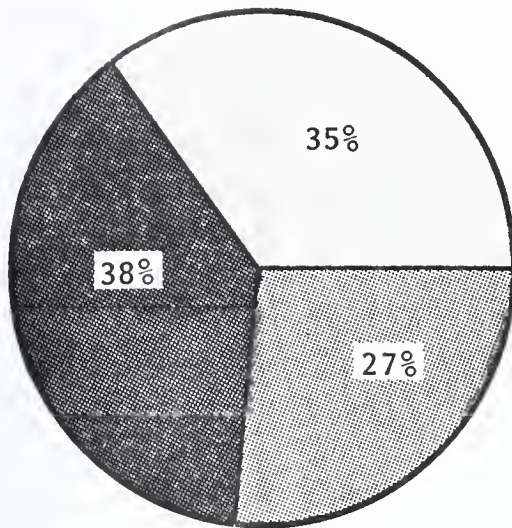


Site Audit

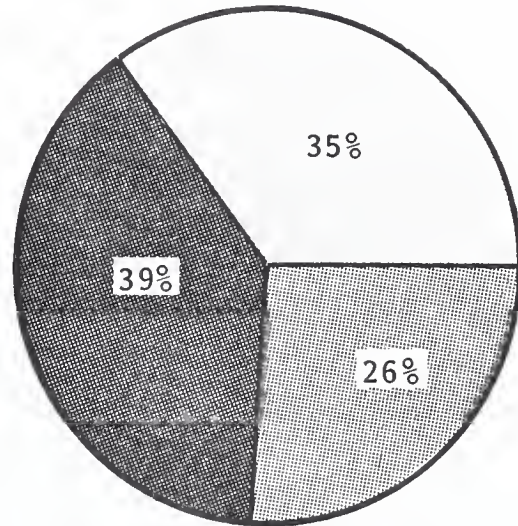
☐ Satisfied
 ☒ Dissatisfied
 ☒ Overkill

EXHIBIT II-3

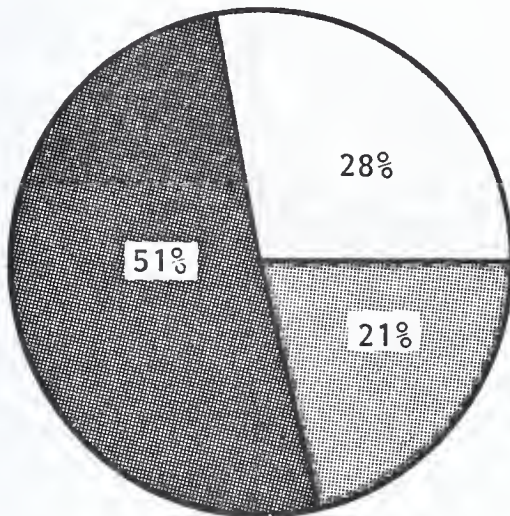
USER REQUIREMENTS VERSUS SERVICE RECEIVED
(Ancillary Services)



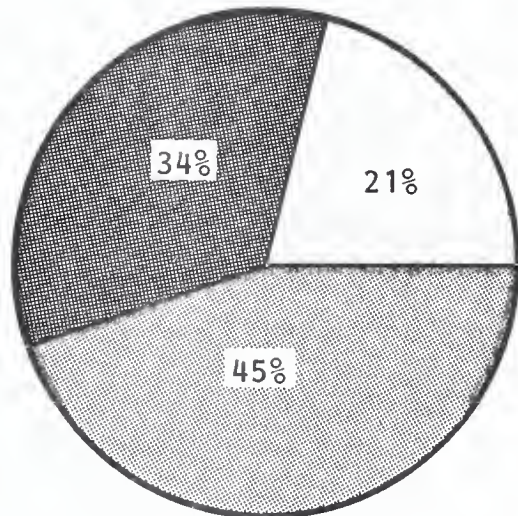
Environmental Planning



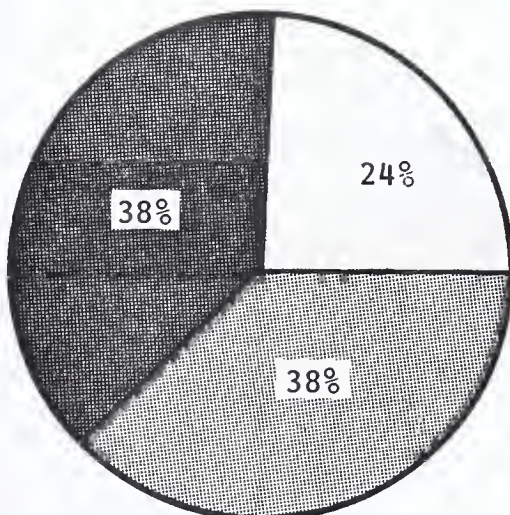
Physical Site Planning



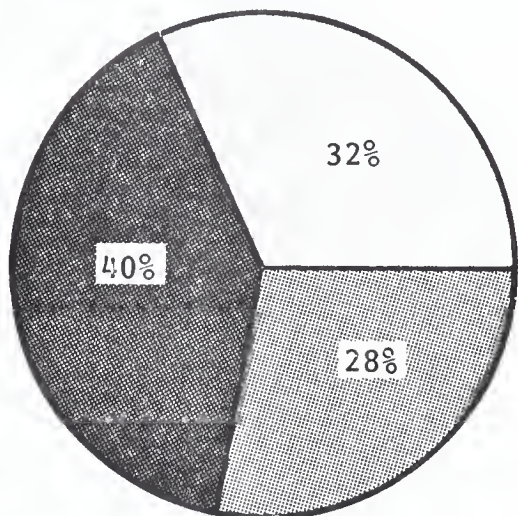
Consulting Services



User Documentation



Training



Installation Planning



Satisfied



Dissatisfied



Overkill

D. USER RATINGS OF VENDORS

- The user requirements vary considerably from vendor to vendor, and the detailed analysis of the top 12 mainframe/mainframe-equivalent vendor user bases is given in Chapter III. However, a summary of the user ratings is shown in Exhibit II-4. The chart does not compare one vendor with another (since the users are rating their requirements against the vendors' services, not one vendor's services with another's).
- The astonishing conclusions that do emerge, however, are:
 - The level of hardware maintenance currently supplied by vendors is substantially below most user's requirements; most vendors do not even receive a "C" rating, and even IBM can improve.
 - Software maintenance is rated below all of the other service categories with Tandem the only vendor rated at a "C." Along with most other vendors, IBM does not score at all on this service.
 - Documentation is also poorly rated by all user groups, with the isolated exception of Tandem users.
 - Training is another major user service requirement that is rated only marginally better than documentation.
- These are all major opportunities for increased levels of satisfaction for the users and increased revenues for the vendors.

EXHIBIT II-4

OVERALL USER RATINGS OF LARGE-SYSTEM VENDORS

VENDOR	USER RATINGS													
	Environmental Planning	Physical Site Planning	Consulting	Documentation	Training	Installation	Hardware Planning	Software Maintenance	Supplies Maintenance	Add-on Sales	Site Audits	Relocation	De-installation	Total Score (A = 3, B = 2, C = 1)
Amdahl	A	A	A	C	C	A	-	-	C	B	B	A	B	24
Burroughs	A	-	B	-	-	-	-	-	B	C	C	A	A	15
Control Data	A	A	A	C	C	B	-	-	A	A	A	A	A	28
Cray	A	B	A	B	-	C	C	-	B	B	-	A	B	21
DEC	B	B	B	C	B	C	-	-	A	A	A	B	C	22
Data General	B	C	A	-	B	B	-	-	C	B	A	A	A	22
Honeywell	A	B	B	-	C	B	-	-	C	-	C	A	A	18
IBM	B	A	A	C	C	A	B	-	C	B	B	A	A	29
NAS	C	B	A	-	-	B	C	-	-	C	A	A	A	19
Perkin-Elmer	B	B	B	-	C	A	-	-	-	B	A	C	A	19
Tandem	C	-	A	A	C	A	-	C	B	C	B	-	A	20
Univac	A	A	B	-	-	C	-	-	-	A	B	B	B	18
Overall Service Scores	28	23	31	9	10	23	4	1	16	22	25	29	31	

A = 25% or less dissatisfied, and at least 50% satisfied - = all grades below A, B and C
 B = 35% or less dissatisfied, and at least 40% satisfied
 C = 45% or less dissatisfied, and at least 30% satisfied

III AFTER-SALES SUPPORT REQUIREMENTS

III AFTER-SALES SUPPORT REQUIREMENTS

A. INTRODUCTION

- This section deals with the user requirements of the installed base of each of the top 12 vendors in the large/medium mainframe marketplace. Their users are first split into three categories:
 - The first category is made up of those who require less than the average level of provided service (overkill) in a particular area (e.g., installation planning), plus those who require service that is equal to or greater than average.
 - Those requiring equal to or greater than average service levels are then divided into two categories:
 - . Those who are satisfied with the service they receive (satisfied).
 - . Those who are not (dissatisfied).
- Each chart also provides an overall measure (on a scale of 1 through 10) of the average level of service required for a given type of service and the overall level received. This indicates those areas of service that require attention.

- Since the user requirements are measured against the vendor's average level of service provided, the values cannot be interpreted as absolute values that allow comparison between vendors. They do show the strengths and weaknesses of each vendor, however, and underline the areas of opportunity in great detail.
- It is important to understand the message of the chart: the user requirements are not being measured against the contractual obligations of the vendor (e.g., two-hour or four-hour response, etc.); users may or may not receive what is contracted for. Users are being asked to say whether the level of service they receive satisfies their requirements. Each vendor should interpret a high dissatisfied value as an area of opportunity for increased service revenue rather than a derogatory comment by users on the maintenance organization.
- Other points to watch for are:
 - If there are high percentages in the overkill and dissatisfied columns, then this is a clear indication that a redirection of service efforts is required; users who require attention are not getting it, while others are receiving more attention than they need.
 - The ideal picture is less than 20% overkill, more than 50% satisfied, and less than 30% dissatisfied; anything more than this would be highly unlikely (the totally satisfied user does not exist).

B. AMDAHL USER REQUIREMENTS

- The Amdahl products surveyed were the 470 series and the 58XX series (very few installed).

- The key areas of opportunity for Amdahl are, in order, hardware maintenance (even shorter response time), software maintenance, systems documentation, and training. This suggests that Amdahl's field service revenue could be increased significantly by responding to the special needs of its users, two of which (hardware and software maintenance) can generate very high revenues. Exhibit III-I summarizes the findings.

1. ENVIRONMENTAL PLANNING AND PHYSICAL SITE PLANNING

- The service provided is generally sufficient. Some redirection of the service effort is required to reduce overkill and dissatisfied levels.

2. CONSULTING AND INSTALLATION PLANNING

- These are overdone; however, it may be marketing's view that those efforts are positive contributors to sales and, as such, are worthwhile even though they go beyond the new requirements.

3. DOCUMENTATION AND TRAINING

- On an overall scale the service provided is less than adequate. Service needs to be improved and effort redistributed.

4. HARDWARE MAINTENANCE AND SOFTWARE MAINTENANCE

- These are the two areas where Amdahl users are least satisfied, and where it is worthwhile to examine their requirements for enhanced field service revenue opportunities.

5. SUPPLIES SALES AND SITE AUDITS

- Significant redirection of the efforts made in these two service areas is required. More than half the users receive more operator service than they need, while more than 25% are dissatisfied.

EXHIBIT III-1

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
VENDOR: AMDAHL

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	6.32	6.06	35.3%	41.2%	23.5%
Physical Site Planning	5.65	4.88	38.2	44.1	17.7
Consulting	5.65	6.38	41.2	44.1	14.7
Documentation	7.18	6.74	32.4	26.5	41.1
Training	7.29	6.71	38.2	23.6	38.2
Installation Planning	5.62	5.47	50.0	29.4	20.6
Hardware Maintenance	9.12	8.00	17.6	26.5	55.9
Software Maintenance	7.47	4.85	26.5	20.6	52.9
Supplies Sales	4.53	1.56	52.9	11.8	35.3
Add-on Sales	6.00	5.24	44.1	23.5	32.4
Site Audits	3.74	2.38	52.9	20.6	26.5
Relocation	6.15	5.24	35.3	44.1	20.6
De-installation	5.79	3.53	41.2	29.4	29.4

* Rating: 1 = Low, 10 = High

= Area requiring improvement

6. ADD-ON SALES

- Again a large proportion (32%) of users require better service than that received, while a high proportion (44%) receive more than they need.

7. RELOCATION

- The service provided is generally adequate.

C. BURROUGHS USER REQUIREMENTS

- The Burroughs' models covered by the survey were the B5900, B6900, and B6800 series.
- A large number of service areas require significant attention:
 - Physical site planning (improved service needed).
 - Hardware maintenance (improved service needed).
 - Software maintenance (misdirected efforts).
 - Documentation (misdirected efforts).
 - Training (improved service needed).
 - Add-on sales (improved service needed).
 - Installation planning (improved service needed).

- Five of the above service areas show that an improvement in the average level of service provided is needed. This should usually mean good revenue opportunities (hardware maintenance, add-on sales), but some areas will mean added effort (e.g., installation planning) or are low-revenue opportunities (e.g., training).
- In a very competitive market, service is often the difference between continued installed base growth and replacement. The picture for Burroughs shows too many areas of user dissatisfaction.
- Exhibit III-2 summarizes the details.

D. CONTROL DATA CORPORATION USER REQUIREMENTS

- The CDC products included in this survey were the OMEGA 1480, the CYBER 170/800, and the CYBER 170/700.
- The summary verdict of CDC's mainframe users is qualified approval. Like most of the large- and medium-mainframe users, CDC's installed base would like to receive better hardware maintenance service. (Some redirection of software maintenance effort is required to satisfy more users while avoiding overkill on service.) Beyond this, the service provided is largely satisfactory.
- Many areas of overkill are identified in Exhibit III-3.
 - Nine out of thirteen types of service provided show more than 40% of users received a higher degree of service than required (overkill).
 - This overkill is an unnecessary expense that is better employed in the two areas with greater opportunity (hardware and software maintenance).

EXHIBIT III-2

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
VENDOR: BURROUGHS

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE *		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	6.04	5.36	32.1%	42.9%	25.0%
Physical Site Planning	6.11	5.11	28.6	25.0	46.4
Consulting	5.04	4.79	39.3	28.6	32.1
Documentation	7.43	5.00	42.9	3.6	53.5
Training	7.21	6.00	28.6	17.9	53.5
Installation Planning	6.68	5.14	28.6	25.0	46.4
Hardware Maintenance	9.14	7.61	21.4	17.9	60.7
Software Maintenance	7.75	5.75	42.9	3.6	53.5
Supplies Sales	6.04	4.79	46.4	21.4	32.1
Add-on Sales	6.46	6.04	28.6	28.6	42.8
Site Audits	5.00	4.25	35.7	25.0	39.3
Relocation	4.29	3.04	50.0	25.0	25.0
De-installation	4.29	3.75	46.4	28.6	25.0

* Rating: 1 = Low, 10 = High

= Area requiring improvement

EXHIBIT III-3

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
VENDOR: CDC

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	6.71	7.21	45.8%	37.5%	16.7%
Physical Site Planning	6.63	6.54	50.0	25.0	25.0
Consulting	5.96	5.54	41.7	33.3	25.0
Documentation	6.50	5.50	45.8	16.7	37.5
Training	6.25	5.79	33.3	29.2	37.5
Installation Planning	6.67	6.46	41.6	29.2	29.2
Hardware Maintenance	8.88	7.79	20.8	20.8	58.4
Software Maintenance	6.21	5.38	37.5	16.7	45.8
Supplies Sales	4.29	3.33	50.0	29.2	20.8
Add-on Sales	5.92	6.33	37.5	45.8	16.7
Site Audits	3.79	3.71	54.2	20.8	25.0
Relocation	4.54	4.29	54.2	33.3	12.5
De-installation	4.79	5.00	45.8	41.7	12.5

* Rating: 1 = Low, 10 = High

 = Area requiring improvement

- The combined percentage of users who are either satisfied or oversatisfied (overkill) exceeds 70% in 9 out of the 13 categories - a solid performance.

E. CRAY USER REQUIREMENTS

- The Cray I was the only product surveyed.
- With few exceptions, Cray's service performance is well received by the user base. Hardware and software maintenance is an area of opportunity for Cray (particularly software maintenance).
- Training is spotty, with half the users receiving less than the necessary service and half more than necessary. Installation planning and site audits are also areas requiring improvement.
- Compared to other installed bases, Cray has a largely satisfied user base (albeit much smaller than the other manufacturers in the mainframe group).
- Exhibit III-4 summarizes Cray's service as rated by the user box.

F. DEC USER REQUIREMENTS

- The DEC mainframe-equivalent products that are included in this analysis are the DEC-10, DEC-20, VAX-11/780, and PDP 11/70 series.
- Apart from the hardware and software maintenance categories, DEC users are reasonably satisfied with the service provided. The key area for improvement is software maintenance, where more than half of the users surveyed require a higher level of service than that which they usually receive.

EXHIBIT III-4

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
VENDOR: CRAY

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	7.5	8.0	40.0%	40.0%	20.0%
Physical Site Planning	7.7	7.9	30.0	40.0	30.0
Consulting	7.6	8.4	30.0	50.0	20.0
Documentation	8.4	8.2	40.0	30.0	30.0
Training	6.7	7.0	50.0	-	50.0
Installation Planning	7.4	8.7	30.0	30.0	40.0
Hardware Maintenance	9.1	8.7	20.0	40.0	40.0
Software Maintenance	7.7	7.4	30.0	20.0	50.0
Supplies Sales	4.8	3.4	40.0	30.0	30.0
Add-on Sales	5.0	6.5	40.0	30.0	30.0
Site Audits	4.7	3.4	40.0	10.0	50.0
Relocation	4.0	4.3	60.0	30.0	10.0
De-installation	6.5	5.5	40.0	30.0	30.0

* Rating: 1 = Low, 10 = High

 = Area requiring improvement

- Other areas that have potential problems are installation planning and documentation. There is a slightly higher than ideal percentage of users in the dissatisfied column.
- More attention than necessary is being applied to consulting, supplies sales, and site audits. Considering the exceptionally high volume of the surveyed products that are being shipped and installed, the results summarized in Exhibit III-5 are commendable.

G. DATA GENERAL USER REQUIREMENTS

- The Data General mainframe equivalent products that were surveyed were the MV/6000 and MV/8000 series.
- Yet again, the user base requires improved service in hardware and software maintenance (particularly the latter, where more than 60% receive less service than they require). Supplies sales and documentation are also below the user requirements.
- Another potential problem area is physical site planning, where the proportion of dissatisfied users is above 38%. The overall performance is comparable to that of DEC (i.e., the DG user base is approximately as satisfied with DG as DEC users are with DEC large products).
- Exhibit III-6 also highlights several areas of overkill, but not in important service categories.

EXHIBIT III-5

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED

VENDOR: DEC

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.77	5.17	36.7%	30.0%	33.3%
Physical Site Planning	5.70	5.10	43.4	23.3	33.3
Consulting	4.73	4.70	43.3	30.0	26.7
Documentation	7.53	7.00	36.7	26.6	36.7
Training	5.83	6.43	46.7	23.3	30.0
Installation Planning	6.37	5.60	30.0	33.3	36.7
Hardware Maintenance	9.20	7.37	20.0	33.3	46.7
Software Maintenance	6.73	4.93	36.7	6.7	56.6
Supplies Sales	4.57	4.90	53.3	26.7	20.0
Add-on Sales	5.80	5.33	46.7	30.0	23.3
Site Audits	3.73	3.33	53.4	23.3	23.3
Relocation	4.93	4.63	43.4	23.3	33.3
De-installation	5.40	4.87	36.7	26.6	36.7

* Rating: 1 = Low, 10 = High

= Area requiring improvement

EXHIBIT III-6

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
VENDOR: DATA GENERAL

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.05	4.38	42.9%	28.6%	28.6%
Physical Site Planning	4.24	3.76	47.6	14.3	38.1
Consulting	3.62	4.81	47.6	38.1	14.3
Documentation	7.24	5.33	19.0	28.6	52.4
Training	6.00	4.76	42.9	23.8	33.3
Installation Planning	5.67	4.95	33.3	33.3	33.3
Hardware Maintenance	8.52	8.19	19.0	33.3	47.7
Software Maintenance	6.33	4.62	28.6	9.5	61.9
Supplies Sales	4.57	2.90	42.9	14.2	42.9
Add-on Sales	4.71	4.33	47.6	23.8	28.6
Site Audits	2.81	2.33	52.4	28.6	19.0
Relocation	3.95	3.14	57.1	19.0	23.9
De-installation	3.33	3.81	52.4	33.3	14.3

* Rating: 1 = Low, 10 = High

= Area requiring improvement

H. HONEYWELL USER REQUIREMENTS

- The Honeywell products surveyed included the DPS7, the DPS8, the 66 DPS, and the 68 DPS.
- Honeywell's users are generally dissatisfied with the key services provided (i.e., hardware maintenance, software maintenance, documentation, and add-on sales). All of these areas are revenue opportunities for Honeywell, and the specific demands of the user base must be addressed.
- Beyond these critical areas the service performance is usually very good, with six out of the remaining nine categories having less than 30% dissatisfied users. There are also no areas of serious overkill, as shown in Exhibit III-7.
- While large mainframe users are difficult customers to satisfy, they represent significant revenues, and the service picture presented in Exhibit III-7 shows an uncomfortably high level of dissatisfaction in key areas.

I. IBM USER REQUIREMENTS

- The IBM products surveyed included the 308X series, the 43XX series, and the 303X series.
- IBM's overall service performance is the best of the mainframe product vendors, bar none. Only one area where major improvements are needed is shown in Exhibit III-8 (i.e., software maintenance, where a large proportion of users require a better service) and only one major area of overkill (site audits, which is the best area to have overkill).

EXHIBIT III-7

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
VENDOR: HONEYWELL

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.45	5.48	36.4%	42.4%	21.2%
Physical Site Planning	6.15	6.48	42.4	30.3	27.3
Consulting	5.12	5.64	30.3	42.4	27.3
Documentation	8.39	6.67	9.1	24.2	66.7
Training	7.00	5.94	24.2	39.4	36.4
Installation Planning	6.03	6.06	36.4	36.4	27.2
Hardware Maintenance	9.15	7.94	21.2	21.2	57.6
Software Maintenance	6.82	5.73	30.3	12.1	57.6
Supplies Sales	4.79	4.12	42.4	21.2	36.4
Add-on Sales	6.97	6.30	30.3	24.2	45.5
Site Audits	4.82	3.48	36.4	24.2	39.4
Relocation	5.12	5.36	36.4	48.5	15.1
De-installation	6.09	6.12	42.4	36.4	21.2

* Rating: 1 = Low, 10 = High

= Area requiring improvement

EXHIBIT III-8

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED

VENDOR: IBM

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	6.85	6.81	35.8%	34.0%	30.2%
Physical Site Planning	6.92	7.11	30.2	45.3	24.5
Consulting	5.96	6.66	45.3	39.6	15.1
Documentation	8.09	7.28	26.4	37.7	35.9
Training	7.47	6.72	39.6	24.5	35.9
Installation Planning	7.43	7.74	28.3	50.9	20.8
Hardware Maintenance	9.28	8.55	47.2	18.9	33.9
Software Maintenance	8.25	6.72	20.8	22.6	56.6
Supplies Sales	5.91	5.08	41.5	22.6	35.9
Add-on Sales	6.96	6.83	32.1	37.7	30.2
Site Audits	5.13	3.94	56.6	17.0	26.4
Relocation	6.34	6.19	41.5	43.4	15.1
De-installation	6.94	7.30	30.2	49.1	20.7

* Rating: 1 = Low, 10 = High

 = Area requiring improvement

- Significantly, IBM is the only mainframe supplier that has less than 35% dissatisfied users in the hardware maintenance service category. Coupled with the enormous installed base, this is a truly exceptional performance.
- Other areas requiring attention include documentation, training, and supplies sales. In the latter category, a redistribution of effort is required (nearly 36% are dissatisfied, while 41% say that there is overkill).
- Exhibit III-8 provides the detailed survey results.

J. NATIONAL ADVANCED SYSTEMS USER REQUIREMENTS

- The NAS products surveyed were the AS/5000 series, the AS/7000 series, and the AS/9000 series.
- Three key service areas and one minor service area require improvement, all of which represent revenue opportunities for NAS:
 - Documentation (major).
 - Training (major).
 - Software maintenance (major).
 - Supplies sales (minor).
- In the dominant area of hardware maintenance a substantial proportion of users receive service equal to or better than their requirements.
- Exhibit III-9 provides the full survey results.

EXHIBIT III-9

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED

VENDOR: NAS

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	6.40	5.60	30.0%	33.3%	36.7%
Physical Site Planning	6.20	5.47	26.7	46.6	26.7
Consulting	5.50	5.33	43.3	33.3	23.4
Documentation	6.67	4.57	40.0	13.3	46.7
Training	6.30	4.60	33.3	20.0	46.7
Installation Planning	6.83	6.10	26.7	46.6	26.7
Hardware Maintenance	9.23	8.73	10.0	50.0	40.0
Software Maintenance	6.63	5.43	36.7	16.7	46.6
Supplies Sales	4.73	1.03	46.7	0	53.3
Add-on Sales	5.63	4.73	26.6	36.7	36.7
Site Audits	4.37	3.10	40.0	36.7	23.3
Relocation	4.63	4.47	40.0	36.7	23.3
De-installation	5.80	5.93	43.3	43.3	13.3

* Rating: 1 = Low, 10 = High

 = Area requiring improvement

K. PERKIN ELMER USER REQUIREMENTS

- The mainframe equivalent products of Perkin Elmer that were surveyed include the 32XX series, the 7/32, and 8/32 series.
- There are a large number of service requirements that need attention according to the users surveyed, either because of high levels of dissatisfaction (e.g., software maintenance, supplies sales), low levels of satisfaction in key areas (e.g., hardware maintenance), or high levels of overkill (e.g., environmental planning, physical site planning, site audits).
- The main area of concern is the high number of categories where users are dissatisfied. (Overkill is a waste of money and effort, but it does not make the customer unhappy.) The users interviewed were frequently dissatisfied with documentation, hardware maintenance, software maintenance, and supplies sales.
- Exhibit III-10 provides the full survey results.

L. TANDEM USER REQUIREMENTS

- The Tandem product surveyed was the Non-Stop I. There were few of these (10) but enough to give broad indications of user requirements.
- Physical site planning, hardware maintenance, and relocation were the three areas of primary concern. Most important of these is, of course, hardware maintenance, which an outsider would expect to see more highly rated. This indicates that while the Non-Stop may provide very high MTBF values, service response to failures (critical or not) is not adequate in the eyes of users. In

EXHIBIT III-10

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
VENDOR: PERKIN ELMER

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE *		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.70	1.95	55.0%	15.0%	30.0%
Physical Site Planning	2.95	0.90	65.0	5.0	30.0
Consulting	3.70	2.25	55.0	10.0	35.0
Documentation	7.80	5.00	30.0	15.0	55.0
Training	3.85	2.60	45.0	15.0	40.0
Installation Planning	3.35	2.65	60.0	20.0	20.0
Hardware Maintenance	8.30	6.90	35.0	15.0	50.0
Software Maintenance	6.00	3.05	25.0	10.0	65.0
Supplies Sales	5.50	1.00	25.0	0.0	75.0
Add-on Sales	5.25	3.90	50.0	15.0	35.0
Site Audits	2.20	0.90	70.0	15.0	15.0
Relocation	4.75	2.55	35.0	25.0	40.0
De-installation	2.75	1.05	65.0	15.0	20.0

* Rating: 1 = Low, 10 = High

 = Area requiring improvement

this regard Tandem may suffer from the effects of its own marketing literature.

- Exhibit III-11 provides the full survey results.

M. UNIVAC USER REQUIREMENTS

- The UNIVAC products surveyed include the 90/60, the 90/70, the 90/80, and the 1100/80.
- Survey results show three areas of concern:
 - Documentation (more than 54% dissatisfied).
 - Hardware maintenance (48% dissatisfied).
 - Software maintenance (58% dissatisfied).
- Readers are reminded that the ideal picture would read as follows for each of the service ratings:
 - Less than 20% overkill (although this is not absolutely necessary).
 - More than 50% satisfied (definitely required).
 - Less than 30% dissatisfied (definitely required).
- In light of these values only one service category is rated as satisfactory by the UNIVAC mainframe users: physical site planning. However, few vendors do any better (if this is a consolation).
- Exhibit III-12 provides the full survey results.

EXHIBIT III-11

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED

VENDOR: TANDEM

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	6.8	5.6	40.0%	20.0%	40.0%
Physical Site Planning	7.0	5.3	30.0	20.0	50.0
Consulting	4.8	4.8	50.0	30.0	20.0
Documentation	8.8	6.7	50.0	30.0	20.0
Training	7.1	6.1	30.0	30.0	40.0
Installation Planning	6.6	6.1	50.0	30.0	20.0
Hardware Maintenance	8.6	6.9	30.0	20.0	50.0
Software Maintenance	6.8	5.0	30.0	30.0	40.0
Supplies Sales	4.3	2.9	60.0	10.0	30.0
Add-on Sales	6.9	6.3	20.0	40.0	40.0
Site Audits	4.4	3.7	40.0	30.0	30.0
Relocation	6.3	3.4	30.0	20.0	50.0
De-installation	4.1	3.4	50.0	30.0	20.0

* Rating: 1 = Low, 10 = High


 = Area requiring improvement

EXHIBIT III-12

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
VENDOR: UNIVAC

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	6.00	6.13	35.5%	41.9%	22.6%
Physical Site Planning	6.06	6.52	35.5	51.6	12.9
Consulting	5.68	5.81	51.6	16.1	32.3
Documentation	6.87	5.58	35.5	9.7	54.8
Training	6.48	5.06	35.5	19.4	45.1
Installation Planning	6.42	6.39	29.0	35.5	35.5
Hardware Maintenance	8.65	7.32	6.5	45.2	48.3
Software Maintenance	7.55	5.52	25.8	16.1	58.1
Supplies Sales	5.35	3.06	35.5	19.4	45.1
Add-on Sales	5.74	5.81	41.9	35.5	22.6
Site Audits	4.84	3.55	38.7	32.3	29.0
Relocation	4.77	4.90	48.4	25.8	25.8
De-installation	4.74	4.97	48.4	25.8	25.8

* Rating: 1 = Low, 10 = High

= Area requiring improvement

IV MAINTENANCE REQUIREMENTS

IV MAINTENANCE REQUIREMENTS

A. SYSTEM AVAILABILITY REQUIREMENTS

- The key user requirement that the field service manager has to satisfy is that of system availability, defined as:

$$\frac{\text{Scheduled Use}}{\text{Actual Use} + \text{Downtime} + \text{Recovery Time}}$$

- System availability includes software failures (both systems and application software) as well as hardware failures, and is the user's view of system performance. The vendor's view frequently does not take into account recovery time and often considers downtime as starting when the field service organization is notified of a failure (rather than actual failure occurrence).
- Exhibit IV-1 measures the users' requirements versus the actual vendor performance. In the mainframe category of equipment, these values must aim for around 97% for total system availability and 99% for hardware only. Actual average performance of the top 12 vendors combined is close to these values.
- Each user group has its own level of needs so that, once more, vendor performance in Exhibit IV-1 should not be compared. However, since each vendor must satisfy his own user base, the comparison of actual availability ratio

EXHIBIT IV-1

SYSTEM AVAILABILITY - USER REQUIREMENTS VERSUS VENDOR ACTUALS

VENDOR	MEAN TIME (Hours)		NUMBER OF RESPONSES	
	REQUIRED	ACTUAL	REQUIRED	ACTUAL
All Vendors	96.79%	96.77%	317%	306%
Amdahl	97.67	97.86	32	31
Burroughs	97.93	98.19	27	27
CDC	95.83	95.23	24	24
Cray	96.39	96.94	10	10
DEC	96.32	96.55	30	24
Data General	92.32	95.04	21	21
Honeywell	97.63	96.83	33	32
IBM	97.68	97.66	53	48
NAS	97.89	97.90	30	30
Perkin Elmer	94.71	92.18	18	20
Tandem	98.09	97.38	8	10
Univac	96.63	97.25	31	29

values with required ratio values shows the degree to which this is being achieved.

- IBM, with by far the largest user base, comes very close, but doesn't completely satisfy its users. The actual difference may appear small, but it must be remembered that this is what the users buy equipment for: availability. Therefore any negative difference between actual availability and required availability must be taken seriously.
- Many vendors on average exceed their users' availability needs. These vendors include:
 - Amdahl.
 - Burroughs.
 - Cray.
 - DEC.
 - Data General.
 - NAS.
 - UNIVAC.
- It is surprising to see how the user requirements vary from one vendor base to another. This variability appears to be due to the expectations that each user group places on the chosen vendor and on the applications run.
 - Data General users require a lot less availability of their equipment than any other user group (and actually receive a lot more than they need).

- Tandem users, on average, are the most demanding (which is, after all, the market that Tandem goes after); they are not fully satisfied even though Tandem's actual performance is better than 7 out of the top 12 vendors.
- Perkin Elmer users require less system availability than the average of all 12 vendors, but they are not fully satisfied.
- Exhibit IV-2 takes this analysis one step further and examines system availability during the users' most critical periods. As would be expected, the average requirement increases from around 97% (for overall system availability, see Exhibit IV-1) to around 99%. (These values are only the expression of what users require, not what they obtain.)
- It is significant that the user of IBM plug-compatible equipment (Amdahl and NAS) require in these crucial periods greater performance of these products than IBM's users require of their equipment. It is also significant that the two most successful equipment vendors (IBM and DEC) are required, on average, to produce generally lower system availability than their rivals. It appears that in order to compete, the other equipment vendors must promise more (and once promised, users expect it). This is an example of how marketing can affect field service.

B. SOURCE OF MAINTENANCE

- Users were asked how important it is to them that they receive maintenance service from a single source. Their answers varied considerably from vendor to vendor (and are revealing in that they imply that some user bases are more vulnerable than others to third-party maintenance services).

EXHIBIT IV-2

SYSTEM AVAILABILITY REQUIREMENTS FOR
USERS' MOST CRITICAL APPLICATIONS

VENDOR	AVAILABILITY REQUIRED (percent)		NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	
All Vendors	98.61%	2.27%	317
Amdahl	99.03	1.23	32
Burroughs	98.92	1.05	26
CDC	98.48	2.39	23
Cray	97.19	2.89	10
DEC	97.14	4.65	30
Data General	98.54	2.45	20
Honeywell	99.21	1.02	33
IBM	98.70	1.75	53
NAS	99.52	0.84	30
Perkin Elmer	97.94	3.11	20
Tandem	98.57	2.10	10
Univac	98.71	1.14	30

- Surprisingly, IBM users are fairly open-minded about multiple source maintenance services; on average they rated sole source as only factor 6.21. This sheds a different light on the opportunities third-party maintenance vendors have with the IBM user base; a substantial portion of them do not object to multiple service vendors.
- This is not the case with other major vendors.
 - Honeywell users are in general determined that they should have a single source of maintenance: Honeywell.
 - Data General users are of a similar mind.
 - Burroughs, UNIVAC, Cray, CDC, and Perkin Elmer are slightly more tolerant of multiple service sources.
- The user bases of the IBM compatible vendors are very open to multiple maintenance service sources (by definition). These users have had to accept this situation for a long time, so it is normal that they should answer in this way.
- One major surprise is Tandem, with a low rating of 5.7. However, many Tandem systems rely on third-party equipment (disks, terminals, printers), and users apparently do not expect Tandem to be the sole source of maintenance.
- Exhibit IV-3 provides the detailed responses for each of the vendors interviewed.

C. USER ATTITUDES TOWARD ALTERNATIVE DELIVERY METHODS

- There has been much debate recently about the need for involving users in either hardware or software maintenance. Leaving aside the pricing/discount-

EXHIBIT IV-3

THE IMPORTANCE TO USERS OF A SINGLE SOURCE OF MAINTENANCE

VENDOR	MEAN	STANDARD DEVIATION	NUMBER OF RESPONSES
All Vendors	6.80	2.86	324
Amdahl	4.74	2.74	34
Burroughs	7.36	2.91	28
CDC	6.92	3.41	24
Cray	7.60	3.63	10
DEC	6.77	2.56	30
Data General	8.29	1.95	21
Honeywell	8.30	1.91	33
IBM	6.21	2.84	53
NAS	6.43	3.23	30
Perkin Elmer	6.90	2.55	20
Tandem	5.70	2.36	10
Univac	7.32	2.34	31

Rating: 1 = Low, 10 = High

ing aspect, Exhibit IV-4 examines the users' attitude toward the principal options that they have compared in the last 12 months.

- Software maintenance is an integral part of the large systems requirements, and INPUT sought the users' attitudes toward self-help, patching, returning software modules, etc. (versus the traditional on-site help).
- On the hardware side, the most popular service delivery methods are the on-site response methods (on-call, and stand-by/on-site people). However, INPUT found significant levels of diagnostics use, both using support centers and remote diagnostic tools. However, users have little enthusiasm for replacing boards or delivering modules for repair.
- On the software side, there is a rising acceptance of remote diagnostic maintenance methods, with the on-line specialist working through a network connection that is gradually replacing the traditional on-site trouble call. The on-site standby support person is not considered necessary, even during critical periods. (This makes sense - either the software works or it doesn't.) There is little interest in returning defective software modules.

D. RESPONSIVENESS TO HARDWARE FAILURES

- For responses exceeding one hour, the response times of the major large-system vendors have been brought substantially in line with user needs. Beyond the one-and-a-half-hour response time there is evidence of substantial overkill (i.e., users receive a response well in excess of their actual needs). Exhibit IV-5 provides the analysis.
- Exhibit IV-5 essentially says that vendors are focusing too much on response time at the expense of productivity, since the effect of minor changes in response time in a service queue is multiplied many times over in productivity analyses. For example:

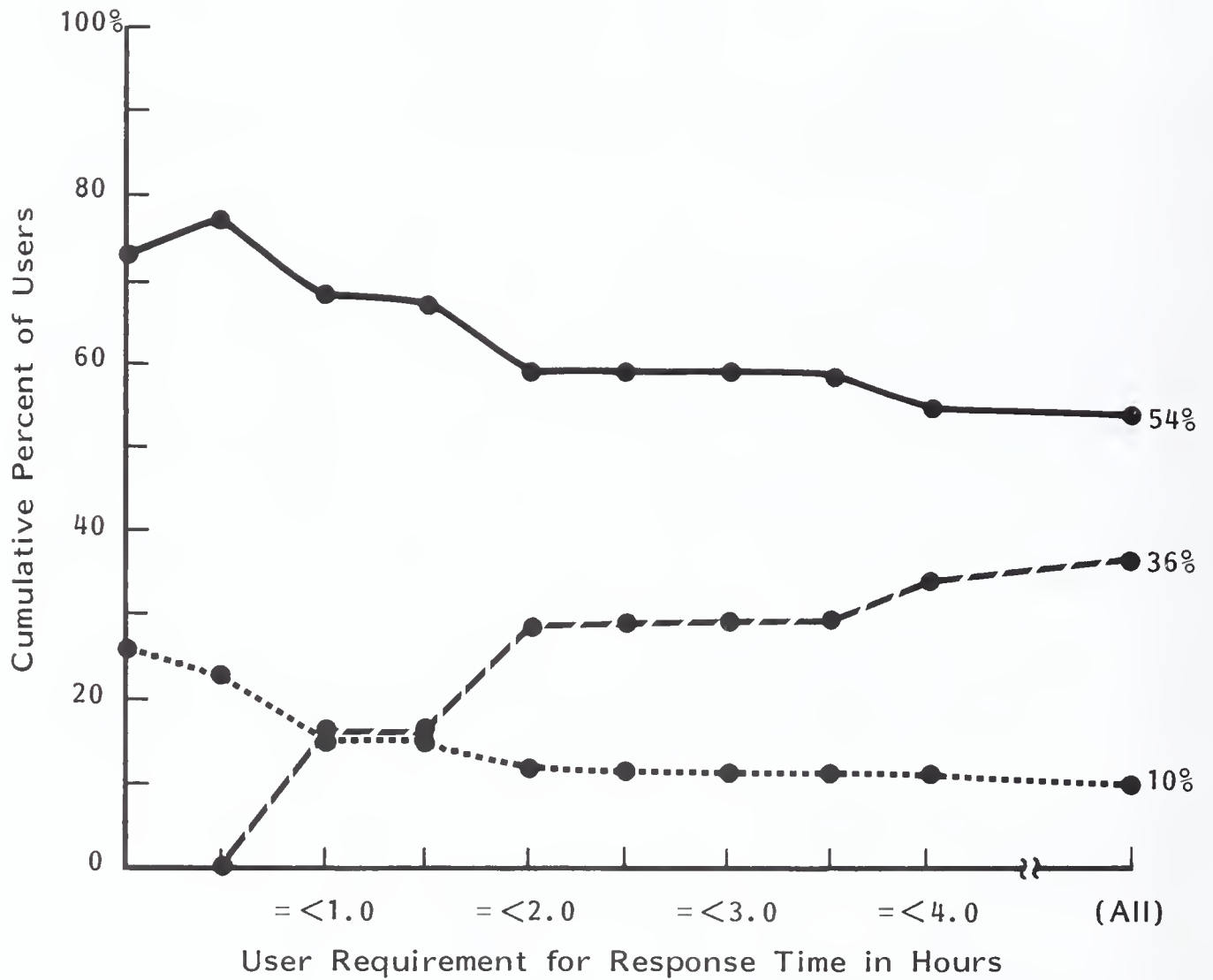
EXHIBIT IV-4

USER ATTITUDES TOWARD
ALTERNATIVE DELIVERY METHODS FOR MAINTENANCE
(Assumes Appropriate Premium or Discount)

MAINTENANCE DELIVERY METHOD	RATING (1-10)			
	HARDWARE		SOFTWARE	
	MEAN	# RESPONSES	MEAN	# RESPONSES
1) Traditional on-site response to trouble calls	8.64	318	7.39	272
2) User involvement in diagnosis using support centers, no remote diagnostics	6.03	312	6.40	275
3) User involvement in diagnosis with remote diagnostics	6.53	299	7.01	263
4) User involvement replacing boards or patching software	4.25	317	5.54	278
5) User delivering modules to repair centers	4.23	311	3.92	234
6) On-site standby of service personnel during critical periods	6.53	307	5.53	264

EXHIBIT IV-5

CUMULATIVE USER REQUIREMENTS - RESPONSE TIME TO TROUBLE CALLS VERSUS ACTUAL AVERAGE RESPONSE TIME BY VENDORS



- = Actual Response Slower than Demand
- - - - - = Actual Response Faster than Demand
- = Actual Response Equal to Demand

- Company A has a response time objective of one-half hour on a system with an average failure rate of one per month (MTBF = 168 hours) and MTTR = three hours. Queuing theory suggests that one FE can handle eight systems and still meet the objective.
- Company B realizes that users don't need one-half-hour response and will be satisfied with one hour. With the same system performance data, the same FE can handle 14 systems - a 75% improvement in productivity.
- The substantial overkill that occurs over and above the two-hour response suggests that a lot of service money is being spent needlessly by vendors.
- Below the one-hour response time, the level of user dissatisfaction rises, although by a small amount. Most large system vendors provide, on average, response times that are superior to their user base needs, as shown in Exhibit IV-6. The degree of overkill is evident from these numbers and translates into unnecessary expense.

E. RESPONSIVENESS TO SOFTWARE FAILURES

- The response to system software failures has to be analyzed in light of both its nature and the effect it has on the system as a whole. INPUT has segmented the analysis into three categories of failure:
 - System inoperable.
 - System significantly degraded.
 - System mildly degraded and problem temporarily circumvented.

EXHIBIT IV-6

REQUIREMENTS FOR RESPONSE TIME TO
HARDWARE FAILURES VERSUS ACTUALS BY VENDOR

VENDOR	MEAN TIME (Hours)		NUMBER OF RESPONSES
	REQUIRED	ACTUAL	
All Vendors	1.78	1.68	324
Amdahl	1.38	0.99	34
Burroughs	1.10	0.82	28
CDC	1.40	0.89	24
Cray	0.68	0.61	10
DEC	2.15	1.84	30
Data General	2.98	2.25	21
Honeywell	1.45	1.36	33
IBM	1.22	0.72	53
NAS	1.17	0.75	30
Perkin Elmer	6.65	7.20	20
Tandem	1.30	1.00	10
Univac	1.26	1.21	31

- The definition of response time used here is the time between failure occurrence and the moment when a software engineer is dedicated by the vendor to resolving the problem.

I. SYSTEM INOPERABLE

- In the response time to system software problems when the system is inoperable, there are large discrepancies between the various user requirements and vendor performance, as shown in Exhibit IV-7. There is no pattern to the differences except that most vendors do not meet their users' requirements.
- There is a significant negative difference between the user requirements and actual vendor performance for:
 - IBM (nearly three times slower to respond than required).
 - UNIVAC (73% below par).
 - Perkin Elmer (68% below par).
- There is a significant positive difference for the following vendors:
 - CDC (of all vendors the best actual response time compared to required response time).
 - DEC (mainly due to the lenient user requirement).
 - Amdahl (which easily outsteps IBM).
- From a productivity standpoint (i.e., providing, on average, the level of response time required by the user group), Honeywell is the most accurate, along with Burroughs, Cray, and to a lesser extent Data General and NAS.

EXHIBIT IV-7

SYSTEM SOFTWARE RESPONSE TIME
WITH SYSTEM INOPERABLE

VENDOR	MEAN TIME (Hours)		NUMBER OF RESPONSES
	REQUIRED	ACTUAL	
All Vendors	2.51	3.17	110
Amdahl	1.07	0.63	8
Burroughs	1.20	1.22	14
CDC	2.22	0.62	5
Cray	0.32	0.48	6
DEC	7.50	2.44	8
Data General	2.65	2.90	5
Honeywell	1.06	1.01	15
IBM	1.26	3.75	17
NAS	0.95	1.33	8
Perkin Elmer	11.88	19.75	8
Tandem	1.88	2.38	4
Univac	1.42	2.46	12

2. SYSTEM SIGNIFICANTLY DEGRADED

- The average time (actual hours) needed to respond to this kind of problem increases by a factor of 2.6 over the "system inoperable" problem, but so does the user expectation (which increases almost as quickly).
- Again vendors do not, for the most part, satisfy their users' requirements, as shown in Exhibit IV-8.
 - IBM is very slow to answer (nearly 11 hours). This slowness occurs despite a very lenient user base that requires a far less rapid response than users of other major vendors. (Note that Burroughs and Honeywell respond twice as fast as IBM, but still do not satisfy their users.)
 - CDC and NAS have a similar response time to Honeywell and Burroughs, but their users are far less demanding and thus user requirements are met.
 - UNIVAC's users are even less demanding, but UNIVAC does not meet their needs.
- The responsive vendors include Amdahl, Cray, Tandem, Data General, CDC, and NAS. Perkin Elmer is not at all in line with its user needs.

3. SYSTEM MILDLY DEGRADED AND PROBLEM CIRCUMVENTED

- The average mean response time of all vendors increases very rapidly for this kind of problem; the majority of vendors, however, satisfy their users at this level, as shown in Exhibit IV-9.
- Some very large swings in actual values (from one vendor to another) are evident, there is no real industry norm. The only consistent performer throughout the three categories of failure is Cray.

EXHIBIT IV-8

SYSTEM SOFTWARE RESPONSE TIME
WHEN SYSTEM IS SIGNIFICANTLY DEGRADED

VENDOR	MEAN TIME (Hours)		NUMBER OF RESPONSES
	REQUIRED	ACTUAL	
All Vendors	6.40	8.39	128
Amdahl	1.30	1.03	11
Burroughs	2.59	5.04	15
CDC	6.22	5.42	5
Cray	0.48	0.48	6
DEC	12.60	14.10	10
Data General	2.75	2.38	4
Honeywell	2.69	5.39	18
IBM	10.21	10.94	27
NAS	4.73	4.73	7
Perkin Elmer	3.00	13.50	6
Tandem	1.60	2.00	5
Univac	15.14	20.75	14

EXHIBIT IV-9

SYSTEM SOFTWARE RESPONSE TIME
WITH MILD DEGRADATION AND PROBLEM CIRCUMVENTED TEMPORARILY

VENDOR	MEAN TIME (Hours)		NUMBER OF RESPONSES
	REQUIRED	ACTUAL	
All Vendors	26.84	38.01	137
Amdahl	12.55	7.42	15
Burroughs	6.77	7.14	15
CDC	6.44	5.30	7
Cray	0.18	0.18	5
*DEC	89.94	43.72	10
Data General	49.50	85.50	4
Honeywell	7.13	6.78	20
IBM	20.36	19.58	26
NAS	15.01	12.37	11
Perkin Elmer	53.83	48.50	6
Tandem	5.00	5.00	2
Univac	26.28	57.59	16

*Distorted by one customer willing to wait three months for service.

- Burroughs, Honeywell, CDC, Amdahl, and Tandem are all in the 5.0-7.5 hour range and generally satisfy their user requirements.
- IBM, NAS, DEC, and Perkin Elmer are an order of magnitude below this response level. They nevertheless satisfy their users (the most important factor). UNIVAC and Data General fail to do this, even though their user requirements are low compared with other user groups. (Note that DEC's values are distorted by one exceptionally forgiving user.)
- The overall ability of each vendor to maintain software, as rated by their users, is shown in Exhibit IV-10.

F. REPAIR TIME

- So far we have dealt with response time. We now look at repair time, defined as the time between the moment an engineer begins to work on the problem and the moment when the problem/failure is solved.
- The majority of vendors have performances at the system level that are close to one another, with three notable exceptions: Cray, Amdahl, and NAS, all of which perform significantly better than the average. Data General, Tandem, and Perkin Elmer have average repair times that are significantly above the norm. Exhibit IV-11 provides the analysis by vendor.
- Exhibit IV-12 provides the user's ratings of vendors for hardware diagnostics and quality repairs, excluding the software element.

EXHIBIT IV-10

USER RATINGS OF VENDOR ABILITY TO MAINTAIN SOFTWARE

VENDOR	MEAN	STANDARD DEVIATION	NUMBER OF RESPONSES
All Vendors	6.90	1.97	259
Amdahl	7.87	1.29	23
Burroughs	7.04	1.72	25
CDC	5.82	2.79	17
Cray	7.90	1.37	10
DEC	6.44	2.28	16
Data General	7.06	2.22	17
Honeywell	7.00	1.59	31
IBM	6.94	1.88	49
NAS	7.36	1.40	22
Perkin Elmer	4.85	2.19	13
Tandem	7.22	1.72	9
Univac	6.78	2.10	27

Rating: 1 = Low, 10 = High

EXHIBIT IV-11

SYSTEM REPAIR TIME EXPERIENCED BY USERS
(HOURS)

VENDOR	MEAN	STANDARD DEVIATION	NUMBER OF RESPONSES
All Vendors	3.45	6.56	307
Amdahl	1.80	1.00	32
Burroughs	3.70	8.99	27
CDC	2.21	1.77	24
Cray	1.14	0.86	9
DEC	4.57	5.58	29
Data General	5.79	10.73	19
Honeywell	3.11	4.32	32
IBM	2.48	3.51	49
NAS	1.92	1.10	28
Perkin-Elmer	8.78	13.20	20
Tandem	6.60	14.59	10
Univac	2.86	4.31	28

Rating: 1 = Low, 10 = High

EXHIBIT IV-12

USER RATINGS OF VENDOR ABILITY TO DIAGNOSE HARDWARE PROBLEMS AND TO MAKE QUALITY REPAIRS

VENDOR	MEAN	STANDARD DEVIATION	NUMBER OF RESPONSES
All Vendors	7.69	1.79	322
Amdahl	8.32	1.20	34
Burroughs	7.32	1.76	28
CDC	7.33	1.86	24
Cray	8.30	1.25	10
DEC	7.63	1.73	30
Data General	7.71	1.52	21
Honeywell	7.52	1.46	33
IBM	8.29	1.08	51
NAS	8.40	1.69	30
Perkin Elmer	6.85	2.28	20
Tandem	6.10	2.47	10
Univac	7.55	1.80	31

Rating: 1 = Low, 10 = High

G. THIRD-PARTY MAINTENANCE AND MANAGEMENT CONTRACTS

- One of the strengths of a third-party maintenance vendor is its ability to offer a single source of maintenance for configurations that use equipment from multiple vendors. The system vendor's answer to that is the management contract, where the vendor acts as the clearing house for fault calls on equipment that is not his own, and manages the subcontracting of the maintenance on such equipment.
- For this reason the analysis of user views on third-party maintenance (TPM) has been grouped with the analysis of the management contract alternative. Results are presented in Exhibit IV-13.
- The first question asked concerned the current use of TPM by the user groups of each vendor. (Note that this question refers to all of the equipment used by the vendor, not the given vendor's equipment; as such, it indicates the propensity of the different user groups to use TPM.)
- The result was that, with a few exceptions, there is now a surprisingly high level of TPM use. One of the exceptions is Honeywell, whose large-system users are the least active in TPM use, but a substantial proportion have considered TPM for single-source maintenance.
- Most user groups have substantial involvement (30%-50%) with TPM suppliers for part of their equipment, and many have considered TPM as a single source for maintenance.
- Their receptivity to a management contract as an alternative to TPM varies from vendor to vendor.

EXHIBIT IV-13

PERCENT OF USERS USING THIRD-PARTY MAINTENANCE
OR CONSIDERING MAINTENANCE MANAGEMENT CONTRACTS

VENDOR	Now Using TPM For Some Equipment (percent)			Have Considered TPM as Single Source for Maintenance (percent)			Would Consider Management Contract as Alternative to TPM (percent)			NUMBER OF RESPONDENTS
	YES	NO	N/A	YES	NO	N/A	YES	NO	N/A	
All Vendors	31.2	68.5	0.3	30.9	67.0	2.2	31.5	64.2	4.3	324
IBM	22.6	77.4	-	41.5	56.6	1.9	39.6	60.4	-	53
Burroughs	39.3	60.7	-	7.1	92.9	-	14.3	78.6	7.1	28
Honeywell	12.1	87.9	-	24.2	75.8	-	45.5	54.5	-	33
Univac	25.8	74.2	-	9.7	87.1	3.2	38.7	54.8	6.5	31
CDC	54.2	41.7	4.2	37.5	58.3	4.2	29.2	62.5	8.3	24
DEC	50.0	50.0	-	50.0	46.7	3.3	26.7	66.7	6.7	30
Amdahl	14.7	85.3	-	38.2	58.8	2.9	23.5	64.7	11.8	34
Data General	42.9	57.1	-	38.1	61.9	-	28.6	71.4	-	21
NAS	30.0	70.0	-	40.0	60.0	-	33.3	63.3	3.3	30
Tandem	40.0	60.0	-	30.0	50.0	20.0	40.0	50.0	10.0	10
Cray	40.0	60.0	-	20.0	80.0	-	-	100.0	-	10
Perkin-Elmer	35.0	65.0	-	15.0	85.0	-	35.0	65.0	-	20

- Burroughs' users have made their decision with regard to TPM and are generally opposed to management contracts.
- Honeywell users are generally opposed to TPM and are very receptive to the management contract concept.
- Over 41% of IBM users who have considered TPM as a single source of maintenance have not pursued it, and nearly 40% would be receptive to a management contract as an alternative.
- CDC large-system users show the highest level of TPM acceptance.

V FIELD SERVICE COMMUNICATIONS

V FIELD SERVICE COMMUNICATIONS

A. INTRODUCTION

- It has been said that real salesmanship begins after the sale: it is the time when the true nature of the vendor, the quality of his product, and the value of the service are manifested - and it is INPUT's contention that these and other responsibilities rest with the field engineering organization.
- High quality, frequent communications between the vendor and the user are crucial to a good relationship and must occur at several levels:
 - At the field engineer's level, which is the fundamental building block of the client's relationship with the vendor.
 - At the field service manager's level. (Users feel they have a right to call upon the manager if the need arises.)
 - At the formal, written level, where the company must be seen to be flexible, responsive, and reasonable - not rigid, legalistic, and unyielding.

B. FIELD ENGINEER AND FIELD SERVICE MANAGEMENT COMMUNICATIONS

- INPUT analyzed the users' view of the effectiveness of each vendor field engineer's communication with them on problems of both hardware and software maintenance. Exhibits V-1 and V-2 detail the responses.
 - Most vendors rate a high level of 8 on a scale of 1 to 10 for hardware maintenance, with one exception (Tandem was rated significantly below the other manufacturers).
 - The scores of most vendors are seriously reduced when users rate the software engineer's communications: average scores drop below 7, and some vendors dropped below that (DEC below 6 and Perkin Elmer below 5).
- The highest combined score on both aspects was obtained by Cray, scoring over 8 on both hardware and software communications.
- It is evident from these and earlier scores that most vendors have a lot of work to do in improving the software side of their maintenance service, not only in the quality of the service provided, but also in the amount and quality of the communications exchanged between vendor and user.
- The managers' own ratings are high, usually well in excess of the software engineer but also usually lower than the hardware engineer. This needs attention since the field service manager is the principal source of backup assistance when the user is dissatisfied with the performance of the front-line troops. Exhibit V-2 shows that only Amdahl and Cray score above 8 (which should be the minimum goal for all vendors), and CDC and Perkin Elmer score below 7.

EXHIBIT V-1

USER RATINGS OF HARDWARE AND SOFTWARE
FIELD SERVICE ENGINEERS' COMMUNICATIONS

VENDOR	HARDWARE			SOFTWARE		
	Mean	Standard Deviation	Number of Responses	Mean	Standard Deviation	Number of Responses
All Vendors	8.05	1.50	324	6.78	2.16	281
Amdahl	8.50	1.11	34	7.89	1.48	27
Burroughs	7.75	2.12	28	6.48	2.26	27
CDC	7.79	1.59	24	6.00	2.66	18
Cray	8.90	0.88	10	8.20	0.92	10
DEC	7.90	1.40	30	5.60	2.33	20
Data General	7.95	1.60	21	6.88	2.52	17
Honeywell	8.00	1.27	33	6.56	2.08	32
IBM	8.11	1.22	53	7.12	1.86	49
NAS	8.57	1.41	30	7.52	1.83	27
Perkin Elmer	7.25	1.92	20	4.40	1.76	15
Tandem	6.90	1.91	10	8.00	1.22	9
Univac	8.29	1.32	31	6.63	2.09	30

EXHIBIT V-2

USER RATINGS OF VENDOR SERVICE MANAGEMENT COMMUNICATIONS AND
GENERAL RESPONSIVENESS OF VENDOR SERVICE ORGANIZATIONS

VENDOR	MANAGEMENT COMMUNICATIONS			GENERAL RESPONSIVENESS		
	Mean	Standard Deviation	Number of Responses	Mean	Standard Deviation	Number of Responses
All Vendors	7.44	1.80	322	7.85	1.80	324
Amdahl	8.29	1.31	34	8.76	1.07	34
Burroughs	7.30	2.11	27	6.93	2.11	28
CDC	6.83	1.66	24	7.83	1.86	24
Cray	8.10	1.45	10	9.00	0.82	10
DEC	7.47	1.83	30	7.83	1.53	30
Data General	7.38	2.01	21	7.62	2.01	21
Honeywell	7.12	1.32	33	7.61	2.08	33
IBM	7.70	1.42	53	8.19	1.27	53
NAS	7.97	1.67	29	8.33	1.73	30
Perkin Elmer	6.30	2.18	20	6.50	2.19	20
Tandem	7.20	1.40	10	7.00	2.31	10
Univac	7.65	1.56	31	7.90	1.56	31

- With regard to overall responsiveness only Cray reached a score of 9. In an equipment category such as the large systems, where each installation is worth millions of dollars, overall responsiveness should be rated above 8. Several vendors miss that mark.

C. TROUBLE CALL DISPATCHING AND ESCALATION PROCEDURES

- Users were asked to rate their vendors on responsiveness in terms of the speed and efficiency with which trouble calls were dispatched and their experience with the established escalation procedures.
- The users' view of trouble call dispatching is being influenced by the kind of communications that occur between the vendor and the user (i.e., it does not necessarily reflect the quality of the actual dispatching procedure, but more on the users' view of the procedure).
- Since this is usually a fully automated procedure, there is no reason why every vendor should not have a rating of 9 or more. In actual fact most vendors have less than 8. Cray is once again the only vendor to score adequately, as shown in Exhibit V-3.
- IBM and both of the IBM-compatible mainframe vendors are the next highest scorers (over 8); all other major vendors scored less than 8.
- In terms of escalation procedures, the same comments apply. The value of escalation procedures is entirely a matter for the user to determine. If it is seen to be effective, it has value; if it is seen to be ineffective (no matter how efficiently organized it may look on paper), it has no value.
- Every vendor should aim at scoring 8 or more in the user ratings. However, many major vendors score less than 7. Cray once again outscores all other vendors, with its users the most satisfied of all the user groups.

EXHIBIT V-3

USER RATINGS OF VENDORS' DISPATCHING TROUBLE CALLS
AND ESCALATION PROCEDURES

VENDOR	DISPATCHING TROUBLE CALLS			ESCALATION PROCEDURES		
	Mean	Standard Deviation	Number of Responses	Mean	Standard Deviation	Number of Responses
All Vendors	7.85	1.79	321	7.55	1.93	290
Amdahl	8.35	1.04	34	8.23	1.33	31
Burroughs	7.56	1.87	27	6.88	2.24	25
CDC	7.58	1.86	24	6.78	2.19	23
Cray	9.10	1.20	10	8.88	0.83	8
DEC	7.83	1.46	30	7.31	2.00	29
Data General	7.70	1.92	20	8.00	1.72	20
Honeywell	7.52	1.70	33	6.73	2.27	30
IBM	8.23	1.31	53	7.86	1.51	49
NAS	8.63	1.22	30	8.52	1.68	23
Perkin Elmer	7.26	2.16	19	6.87	2.39	15
Tandem	6.80	2.40	10	7.44	1.81	9
Univac	7.94	1.50	31	7.54	1.73	28

D. RESOLUTION OF INVOICING DISPUTES

- Although invoicing disputes are the responsibility of administration (whether or not under the direction of the vice-president of customer services), they directly affect the image of the field service organization. The site engineer is also frequently involved in relaying the customer's point of view back to the vendor, although the engineer is almost always powerless to affect the outcome.
- Since invoicing disputes directly reflect the field service image, they have been included in this chapter on communications. The data is provided in Exhibit V-4.
- Tandem is rated by its users as the most responsive, and yet again Cray performs well above the mean; however, it is a far easier task for Cray (with a small number of installations) than for vendors like IBM or Honeywell. In this light, DEC performs very well despite a very high volume of installations.
- Vendors experiencing problems include Burroughs, Honeywell, and Data General.

E. VENDOR INITIATIVE

- In many instances, it is easier for the site engineer than for the user to initiate procedural or other changes that will improve the user's operations.
 - The engineer has a better perception of what can and cannot be done at a given site.

EXHIBIT V-4

USER RATINGS OF VENDOR RESOLUTION OF INVOICING DISPUTES

VENDOR	MEAN	STANDARD DEVIATION	NUMBER OF RESPONSES
All Vendors	6.99	2.33	257
Amdahl	7.91	1.74	22
Burroughs	5.38	2.50	24
CDC	6.17	2.28	18
Cray	9.33	0.82	6
DEC	8.04	1.46	25
Data General	5.27	2.71	15
Honeywell	5.84	2.81	31
IBM	7.58	1.67	45
NAS	7.77	2.05	22
Perkin Elmer	6.92	2.33	13
Tandem	8.38	1.60	8
Univac	7.04	2.15	28

Rating: 1 = Low, 10 = High

- The engineer has knowledge of customer support activities in many other user installations and knows how effective they are.
- The engineer understands the internal workings of the vendor's service organization and can be very effective in "oiling the wheels."
- The attention paid by the service organization to customizing the user's support is well appreciated by the users, who graded their vendors on their initiative in Exhibit V-5. There are substantial differences from one vendor to another.
- No vendor was graded higher than 7.8 (Cray), and IBM was graded lower than 7. Vendors graded at 6 and below should consider what steps they can take to encourage their engineers to take charge of the installations for which they are responsible and to work with the user to achieve the user's desired service performance.
- This does not mean making concessions in contract options, prices, etc. It means taking the trouble to examine what can be achieved within the vendor's service policies to make the user happier with the support received.

EXHIBIT V-5

USER RATINGS OF VENDORS TAKING INITIATIVE TO IMPROVE USER OPERATIONS

VENDOR	MEAN	STANDARD DEVIATION	NUMBER OF RESPONSES
All Vendors	6.13	2.31	313
Amdahl	6.94	2.05	33
Burroughs	5.56	2.44	27
CDC	5.33	1.95	24
Cray	7.80	0.92	10
DEC	6.07	1.98	29
Data General	5.40	2.78	20
Honeywell	5.22	2.12	32
IBM	6.49	2.21	32
NAS	6.87	2.39	20
Perkin Elmer	4.76	2.95	17
Tandem	7.20	1.87	10
Univac	6.43	2.10	30

Rating: 1 = Low, 10 = High

VI FIELD SERVICE PRICING

VI FIELD SERVICE PRICING

A. USER RESISTANCE TO PRICE INCREASES

- As the reliability of large-scale systems has increased and the price of the hardware has decreased, users have become more and more resistant to service price increases on standard shift contracts. This tendency will continue, with the resistance to price increases turning into expectance of service price decreases that are compatible with continued hardware price decreases and higher system reliability.
- This resistance is of critical importance to field service managers who will be pressured by marketing into making concessions that are in line with the competition's. IBM has fired the first warning shot with the 4300 series, which has a vastly improved service cost in relation to the equipment it replaced (370 series, models 138 and 148).
- Revenue must be found that offsets this potential drop in basic shift revenue and that maintains service revenue growth. In the large-system area this can be achieved in several ways.
 - Users' requirements for extended services (which produce premiums that go with the service level provided).

- Incorporate new revenue sources into field engineering (e.g., add-on equipment sales, supplies, upgrades).
- Extend the term of the present contracts (to protect the current revenue base).
- These elements of pricing strategy are discussed in the paragraphs that follow.

B. USER REQUIREMENTS FOR EXTENDED SERVICES AND ATTITUDES TOWARD PREMIUMS

- The first thing to establish was what sort of extended services the users required. A number of services proposed by INPUT found favor with the users in sufficient numbers to merit consideration, as shown in Exhibit VI-I.
- Principal among these (in premium value) was guaranteed uptime, for which users were willing to pay a substantial premium (over 10% of basic maintenance charge). This acts like a bonus scheme in reverse: if the system does not provide uptime equivalent to a guaranteed minimum, the user pays nothing if the minimum is exceeded, the vendor is rewarded with a bonus (the premium).
- Other less-direct versions of this idea were less appealing to users.
 - Guaranteed response time is attractive to users, but there is little value attached (average premium of 4%).
 - Guaranteed repair time was less attractive (29% had this requirement), but the premium users were willing to pay is high (over 9%).

EXHIBIT VI-1

USER REQUIREMENTS FOR EXTENDED SERVICES AND
ATTITUDES TOWARD PREMIUMS

EXTENDED SERVICE	USERS RESPONDING YES TO REQUIREMENT		REASONABLE PREMIUM AS PERCENTAGE OF BASIC CHARGE FOR MAINTENANCE (percent)	
	NUMBER	PERCENTAGE OF USERS	MEAN	STANDARD DEVIATION
Standby Coverage During Critical Periods	140	43.2%	8.8%	17.7%
Guaranteed Uptime	113	34.9	10.8	23.1
Guaranteed Response Time	176	54.3	4.0	9.7
On-Site Spare Parts	183	56.5	2.8	6.0
Remote Diagnostics	154	47.5	3.1	7.2
Preventive Maintenance and Engineering Changes During Off-Prime Hours	229	70.7	3.2	10.2
Occasional Shift Coverage Versus Fixed Schedule	102	31.5	4.0	7.6
Full-Time, On-Site Service Engineer	99	30.6	2.6	6.9
Guaranteed Repair Time (Hardware)	94	29.0	9.8	23.0
Guaranteed Turnaround on Software Problems	65	20.1	4.6	9.5

- Standby coverage during critical periods was another popular item in terms of demand. (Over 40% of the large-scale users interviewed responded "yes," even when there was a substantial premium attached.)
- A confirmation of the attraction of remote diagnostics (RD) was obtained, but users are willing to pay only a small premium for it (just over 3%). Users see RD as a productivity tool for the vendor, not as an added benefit to themselves.
- One surprising response was the overwhelming proportion of users that would consider paying a small premium to have preventive maintenance and engineering changes accomplished during off-prime hours.
- Lastly, on-site spares are attractive, but the average user has no desire to purchase them. However, the user is willing to pay a premium over the normal monthly maintenance charge to offset the vendor's cost (tying up money in idle inventory).

C. LEVEL OF PREMIUM THAT USERS ARE WILLING TO PAY

- In answering the question "How much of a premium will users pay for each of the extended service options?" it is useful to be able to see how quickly user acceptance falls off as the amount rises. In this manner the optimum revenue level can be approximately determined.
- Exhibit VI-2 shows the percentage of users that will accept payment of successively higher levels of premium. For example, with standby coverage during critical periods:
 - 52.9% of users agree that this is worth paying for.

EXHIBIT VI-2

CUMULATIVE DISTRIBUTION OF REASONABLE PREMIUMS FOR EXTENDED SERVICES

EXTENDED SERVICE	PERCENTAGE OF USERS REQUIRING EXTENDED SERVICE WHO WILL PAY PREMIUM OVER BASIC MAINTENANCE CHARGE									
	PREMIUM GROUPS									
	> 0%	> 5%	> 10%	> 15%	> 20%	> 25%	> 30%	> 40%	> 50%	> 75%
Standby Coverage During Critical Periods	52.9%	32.1%	19.3%	17.9%	12.1%	8.6%	6.4%	5.0%	2.1%	2.1%
Guaranteed Uptime	54.9	32.7	21.2	15.9	10.6	8.8	7.1	7.1	5.3	5.3
Guaranteed Response Time	39.8	21.6	8.0	5.7	2.8	1.7	1.1	0.6	0.6	0.6
On Site Spare Parts	30.1	14.2	7.1	6.0	2.2	1.1	-	-	-	-
Remote Diagnostics	29.2	14.3	7.1	5.8	3.2	2.6	0.6	0.6	-	-
PM and Engineering Changes Installed Off-Prime Shift	34.5	15.7	3.9	2.2	1.7	1.3	1.3	0.9	0.9	0.9
Occasional Shift Coverage Versus Fixed Schedule	46.1	21.6	8.8	4.9	3.9	2.9	2.9	-	-	-
Full-Time, On-Site Service Engineer	29.3	13.1	5.1	5.1	2.0	1.0	1.0	1.0	-	-
Guaranteed Repair Time (Hardware)	48.9	27.7	20.2	16.0	10.6	7.4	6.4	6.4	5.3	5.3
Guaranteed Turnaround on Software Problems	53.8	23.1	7.7	6.2	3.1	3.1	3.1	3.1	-	-

- 32.1% agree to pay at least a 5% premium.
- 17.9% agree to pay at least a 15% premium.
- By multiplying the minimum premium by the percentage of users agreeing to pay that level of increase, the optimum increase is obtained. Simultaneously, one obtains the percentage increase that can be expected over normal monthly maintenance charge (MMC) revenue. In this example 15% is the optimum level of premium, yielding a 2.7% increase in overall MMC revenue.
- Fifteen percent premium seems to be a psychologically acceptable premium level for the desirable extended services; two other services have this same optimum level of premium.
 - Guaranteed uptime.
 - Guaranteed repair time.
- A desirable extended service option has another characteristic: despite rapidly escalating premiums (up to and in excess of 75% above MMC), there always remains a small group of users that refuses to be put off. Five such examples are shown in Exhibit VI-2.

D. NEW REVENUE SOURCES FOR FIELD ENGINEERING

- Throughout this report INPUT has maintained that the role of field engineering is after-sales support, not just maintenance. The logical consequence of that position is that customer management devolves to the site engineer.
- This means, in terms of new revenue sources for field engineering, that sales of both new hardware (in the shape of add-ons, features, model upgrades) and

software packages could be the responsibility of the field engineering group. But this does not mean that the field engineer would become a salesperson.

- In Exhibit VI-3, the users' view of the field engineer in a sales role is addressed. Clearly many users do not favor such a development, except in hardware-related areas (where the user believes the field engineer has expertise).
- Surprisingly, a majority of users oppose site engineers who sell supplies or software (mostly in cases where users do not yet believe they have expertise). Also, note that users distinguish between new models of hardware (where they oppose a site engineer who sells) and add-ons/upgrades.
- Obviously, any move to have field engineering take charge of hardware sales to existing clients will be opposed by more than just the user base: marketing is unlikely to give up this lucrative source of reserve without a fight. However, INPUT believes it is necessary and will happen in the near future.

E. CHANGES IN MAINTENANCE CONTRACTS

- There are two objectives in making the various service contract administrative provisions that are proposed in Exhibit VI-4:
 - Offer clients something they feel comfortable with or need in exchange for additional revenue (e.g., unbundled software maintenance, variable shift coverage).
 - Lock in existing service contract revenue (e.g., long-term contracts, automatic renewals).
- Some of the options proposed by INPUT received immediate approval by the users.

EXHIBIT VI-3

USER ATTITUDES TOWARD FIELD SERVICE ENGINEERS IN SALES ROLE (percent)

FIELD ENGINEER'S SALES ACTIVITY	STRONGLY FAVOR	MILDLY FAVOR	NEUTRAL	MILDLY OPPOSE	STRONGLY OPPOSE
Supplies	0.9%	23.5%	13.6%	35.8%	26.2%
Hardware Features	2.2	47.8	8.0	23.5	18.5
Add-On Equipment	2.5	44.1	9.9	25.6	17.9
New Models of Equipment	2.8	34.3	9.3	32.4	21.3
Upgrades	7.4	44.1	7.7	23.5	17.3
Software Packages	3.1	19.4	12.3	42.0	23.1

 = More than 50% of Users in Favor or Neutral

EXHIBIT VI-4

CHANGES IN MAINTENANCE CONTRACTS
(percent)

CONTRACT ADMINISTRATION PROVISION	FAVOR	NEUTRAL	OPPOSE
Long-term Contracts (> 1 Year)	57.1%	13.9%	29.0%
Automatic Renewal	57.4	9.6	33.0
Variable Shift Coverage	70.1	13.6	16.4
Standardized Forms (Versus Negotiated Contracts)	34.3	17.0	48.8
Annual Invoicing	24.4	13.0	62.7
Unbundled Hardware Maintenance	50.0	21.0	29.0
Unbundled Software Maintenance	49.4	24.1	26.5



= Areas where more than 60% of users either favor or are neutral to the contract provision

- Variable shift coverage (an exceptionally high response in favor).
 - Long-term contracts. (Users would like the convenience of a stable, identifiable service cost, as much as vendors would like the guaranteed revenue stream.)
 - Automatic renewal, which avoids reissuing modified contracts and generally simplifies paperwork.
- Annual invoicing is not favored because of the cash flow implications (and the lost interest when vendors bill in advance of the service rendered).
 - The standardization of forms has almost as many in favor as opposed. The attraction is the ability to process the contract conditions once and for all through comparable legal approvals. The disadvantage is that no negotiation is possible, so that the contract cannot be customized to particular needs.
 - Vendors should take advantage of the current user preference for long-term contracts. Sooner or later the user will realize there is a trend toward reduced maintenance charges, and they will not want to sign anything for longer than one year.

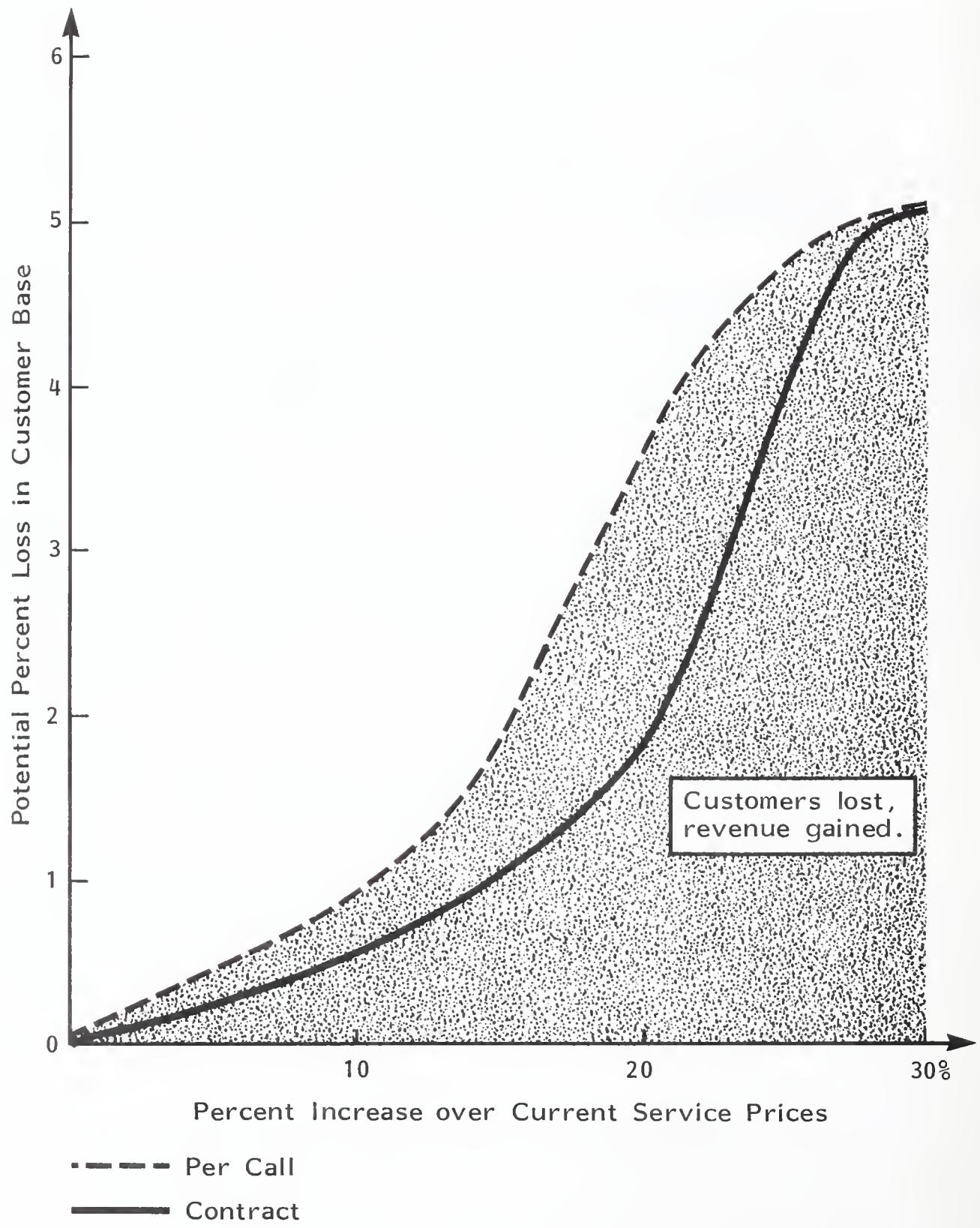
F. SERVICE-RELATED PRICE ELASTICITY

- Very few service vendors carry out regular reviews of the service price elasticity of their product lines. This is a standard business technique applied broadly in many other industries and has a value for every service manager who seeks to optimize his service revenue.

- The usual approach is to establish a relationship between service pricing and the potential revenue gain or loss (i.e., according to the impact on the user base). The main assumption is that all data elements (e.g., service characteristics such as service quality, service contract options, etc.) remain constant. This is why it is necessary to constantly review the price/demand curves as the data elements are modified.
- The slope of the price/demand curve for large-scale systems is relatively flat, as shown in Exhibit VI-5, because the number of customers to be gained by a price decrease is minimal (IBM excepted). Equally, the number of customers that would be lost is quite small for substantial price increases (e.g., 8% loss for a 20% increase).
- The curve for per-call business (as opposed to contract services) is far steeper. This is mainly because the labor content is far more visible in per-call business; since this is the main item that changes, it becomes very visible very quickly.
- The price-increase/lost-clients quadrant is the only one that need occupy large-systems field service managers, they should constantly be thinking of ways of moving into this quadrant while avoiding customer losses. This move can be achieved in several ways:
 - Contractually.
 - Improved service that offsets the price increases.
 - Decreasing the ability of alternative vendors (e.g., by making spares more difficult to obtain).

EXHIBIT VI-5

LARGE SYSTEMS PRICE /DEMAND CURVE



VII STRATEGY RECOMMENDATIONS

VII STRATEGY RECOMMENDATIONS

- Plans that aim at resolving today's requirements have a built-in defect: they do not allow for how requirements will change during implementation. Unfortunately, most large corporations have a significant lag time in implementing new programs or changes to existing ones; frequently it's as much as a year. Therefore, in responding to user needs, vendors must take into account both the short-term immediate needs and the more fundamental underlying trends.

A. USER REQUIREMENT TRENDS

- At this stage in the users' maturing attitude toward service, the following major characteristics are evident:
 - The recent economic difficulties have virtually stopped the flow of regular maintenance price increases that users have become inured to; users now scrutinize every increase for justification and will resist any resumption of unsubstantiated increases.
 - Users are being constantly reminded that products are getting more reliable and hardware prices are dropping: They therefore ask "How can service price increases be justified?" This is an ominous warning to vendors.

- There is a willingness on the part of users to pay for what they need. This means that vendors must be prepared to offer flexible options for extended service if the vendor wishes to increase service revenue from customers.
- Users are clearly attracted by all forms of insurance.
 - Guaranteed uptime.
 - Guaranteed performance.
 - Guaranteed response time.
- There is every reason, therefore, for vendors to adopt a service pricing format that responds to individual needs. For example, a user will pay a moderate fixed fee for a guarantee that may never be needed (but if it is, there will be no additional charge).

B. IMMEDIATE USER NEEDS

- The recommendation for each vendor, in the short term, is to respond to its own user-base needs and correct the problems that users have identified. No general recommendations are possible since each vendor's problems are unique. Therefore, a summary of the more salient needs of each vendor is provided below. The summary indicates what each vendor has to do (if anything) to improve the service he currently provides. Positive aspects are included as well as negative ones. Overall user ratings of large system vendors are provided in Exhibit VII-1.

EXHIBIT VII-1

USER RATING OF LARGE-SYSTEM VENDORS (OVERALL IMAGE)

VENDOR	OVERALL RATING	STANDARD DEVIATION	NUMBER OF RESPONSES
Amdahl	8.53	1.08	34
Burroughs	6.75	1.99	28
CDC	7.46	1.69	24
Cray	8.60	0.97	10
DEC	7.83	1.34	30
Data General	7.43	2.11	21
Honeywell	7.27	1.53	33
IBM	8.25	1.16	53
NAS	8.37	1.65	30
Perkin Elmer	6.95	2.48	20
Tandem	6.90	2.13	10
Univac	7.55	1.63	31
Total	324		

Rating: 1 = Low, 10 = High

1. AMDAHL

- "Very responsive; their philosophy is that any problem we have is their problem until it is remedied; very reliable."
- "Amdahl must remember that IBM is a tough competitor; they need to be more thorough in their (after sales) follow through."
- "Response time is not all it should be; we need an on-site FE or better response time."
- "On-site diagnostics needed, not remote diagnostics."
- "Amdahl doesn't go down very often; but, when it does go down, it is for a long time."
- "They need to have a higher level of expertise or software; they do a respectable job on hardware maintenance."
- "Amdahl's push for growth often means that their FEs are not trained as fully as they should be."
- "They need more depth in their FE force."
- Overall, Amdahl's users had a lot of positive things to say about the company and a large proportion of those interviewed could not fault their service. A common remark was "Amdahl does not finger point."

2. BURROUGHS

- Burroughs users say they have a lot of field service problems, and the range of their comments covers practically all aspects of the business:

- "Burroughs needs to hire qualified FEs and a lot more of them, both for hardware and software; I'm tired of being left in the queue." (common)
 - "Maintenance should not be considered to be a lean and mean profit center - they should be more helpful."
 - "Communications should be improved between the local and regional FE groups - when software problems cannot be fixed locally, the difficulties really begin."
 - "Software should get better field testing before release."
 - "The quality of their software engineers is below that of other vendors."
 - "The FEs need better parts availability."
 - "If you get your service from a high enough level, you get good service, but at the lower levels while the desire is there the tools are not."
 - "Burroughs' FEs need a better understanding of the products they are dealing with and at the local level a more efficient evaluation procedure for obtaining help."
 - "I'm constantly having problems with invoicing."
 - "I'm waiting to see how the hardware and software field service consolidation is going to work out."
- There are enough comments on the need for greater FE training and better software maintenance to justify Burroughs taking a hard look at those two areas. However, even though the remainder are often isolated comments, it is disturbing to see so many complaints surfacing.

3. CDC

- Out of the users interviewed, approximately 35% had no complaints. Those that did can be ranged into two categories:
 - Mildly critical.
 - Very critical.
- Mildly critical:
 - "Need better training of field engineers on the equipment they are servicing, plus more coverage." (many)
 - "Putting out hardware faster than they can train and recruit qualified personnel."
 - "They need improved parts availability." (several)
 - "The FEs and service management should show more initiative in assisting the customers."
 - "The higher (service) level staff should be more responsive to their own FEs and assist them more." (several)
- Very critical:
 - "CDC has a real FE problem."
 - "CDC does not have a positive attitude toward maintenance and seems to be more concerned about making a profit than meeting customers' needs."

- Ignoring the isolated emotional comments, there remains the fairly widespread concerns about FE training, FE support by management, and parts availability. All of these can be addressed with standard procedures and should not be difficult to correct for CDC.
- One particular comment that occurred several times was that CDC should provide their FEs with the service history of the sites they are servicing, so that time is not lost on-site in bringing the FE up to speed.

4. CRAY

- Cray's users are in general very complimentary on the service provided to them and have few complaints. Those that are critical seem to have two needs: improved software maintenance and support, and better-trained FEs, due to the growth of Cray's installed base.

5. DATA GENERAL

- Data General appears to be in a period of recovery, improving their field service in the eyes of their customers with respect to past performance. A number of users noted that DG "is getting its act together now."
- Service still tends to be stretched a little thin, so that FEs are under time pressure. Users notice this. The FE turnover is of concern to the users, too.
- Comments included:
 - "DG should improve communications between sales and the FE."
 - "FEs need more training, particularly on our particular system."
(several)

- "Management communication has been poor."
- "Need more spares locally." (several)
- "Software service must be much more responsive to users' needs."
- On the whole, however, Data General is seen as visibly improving its service, and the complaints are a small percentage of the number of users interviewed.

6. DEC

- A substantial proportion of DEC users had either no complaints (23%) or minor ones (13%). The remainder divide into four groups:
 - Criticism of DEC field service management:
 - "Field service management should improve their responsiveness to customers - they appear to be defensive."
 - "Better management communications are needed." (several)
 - "Management should become more involved in early maintenance problems and improve escalation procedures."
 - "Field engineers need better management support."
 - Need for better parts availability (particularly on-site spares, with user involvement in replacing parts).
 - FE training below the requirement.
 - Software maintenance. (Regional and local support should be brought up to the same level as hardware maintenance.)

- The overall assessment by the user base is that DEC is doing well on hardware service, with users particularly pleased with the Digital Diagnostic Center. The integration of software maintenance with hardware maintenance does not appear to have been satisfactorily resolved yet.

7. HONEYWELL

- Honeywell's service performance is hard to pin down. Few users have major problems; those that do have a variety of difficulties, which do not fall into neat categories. A sample of the comments follows:
 - "Honeywell has to provide better qualified engineers, particularly with a broader set of skills; they're all specialists in narrow areas."
 - "Honeywell's parts are very hard to get; this is a real problem."
 - "Inadequate maintenance response to our problems; if we ever changed vendors, it would be because of maintenance."
 - "Occasionally we suffer very poor response time."
 - "Escalation is tough; if the local guy cannot handle a problem, it will take forever to fix; remote diagnostics aren't pinning the problem down."
 - "Honeywell's dispatches take calls, but because they are not always able to reach their service people, repairs take longer than they should."
 - "Intra-company communications are not good; when you speak to one part of the company on a problem, it is not relayed on to the branch office."

- The comments cover all aspects of service, from user training to invoicing and cannot be taken as a statistically significant indication of a problem area. Two areas that users do agree on, however, are software support and FE training:
 - "Honeywell needs more qualified FEs." (several)
 - "Software support should be accomplished by the local people rather than regional support centers."
 - "They need to improve the reliability of the software they sell and the quality of FE training."
 - "Local FEs should support software as well as they support hardware; needs a higher level of expertise."
 - "They should improve the diagnostics of software problems."
- Out of those interviewed, 27% criticized software support in one way or another and 21% targeted FE training, indicating a real need for improvement in these areas. Honeywell's overall large-system service performance is below what it should be, given the important position the company holds in the marketplace.

8. IBM

- IBM's service received generally good appraisals from the user base, there were few serious problems. FE training and software support also surfaced with the IBM users, but more as a comment than as a critique. Each critical comment was a one-of-a-kind comment and no categories (other than the two mentioned) surfaced.

- IBM's overall image rating is below that of the smaller Cray, Amdahl, and NAS. This is to be expected. It is also above the other main vendors (DEC, UNIVAC, Honeywell, etc.), and this is also to be expected.
- One issue that appears to be peculiar to IBM is that users who have been a pure IBM shop and then decide to use another vendor's equipment as part of their overall DP equipment notice a drop-off in the service attention supplied by IBM. One user was specifically warned that once they installed the Amdahl they were planning on, the service for their IBM equipment would deteriorate. This kind of attitude, if true, does not serve IBM's best interests.

9. NAS

- Fifty-seven percent of the users interviewed were very pleased with the service they receive from NAS, and are very complimentary about the FEs. Some had quibbles with the field service managers ("too busy with their problems to worry about mine"), but the overall performance is good.
- There were some criticisms of software maintenance and the level of parts availability, but NAS fully merits its high position in the large-scale vendor rankings.

10. PERKIN ELMER

- Perkin Elmer has three well-defined service problems according to the users:
 - Software service and support.
 - Response time.
 - Parts availability.

- Only 15% of the respondents found no fault with the service received, but FE training, the common fault of all other vendors, was mentioned by Perkin Elmer users.
 - "Software support needs to be improved, particularly with the operating system."
 - "Communications with the software support group are very bad."
 - "Need to improve software support response time."
- Response time: 25% of the users interviewed called for better response time.
- Parts availability: this was considered to be a problem for 25% of the users, who also thought that the cost of spares was too high and that the local supply ought to be improved.

11. TANDEM

- Despite its product image of high reliability, Tandem does not rate well with users on service. The reasons are not clear-cut and include FE response time, software maintenance, and spares availability. The one clear requirement is better FE training on the special requirements of real-time systems.
- This is a disturbing picture; the overall rating is poor. However, few clear problems that can be targeted for resolution are identified by the users.

12. UNIVAC

- UNIVAC's overall rating is slightly above the average of the other large-system vendors. Twenty percent of the users interviewed either praised the service they receive or did not fault it.

- The major problem areas are well defined and equally important:
 - Software service and support (29%).
 - FE training.
- Software service:
 - "UNIVAC's capability to fix a software problem is not as good as for hardware; the software engineers do not keep up with the new system software releases."
 - "They need (to release) better software products to begin with, and to improve local software support." (many)
- Apparently, the user perception of the lack of FE skills is partially related to UNIVAC's move to consolidate offices, which stretches the coverage. As a result, some products are not receiving adequate support:
 - "UNIVAC needs to train its FEs and users more on new hardware."
 - "UNIVAC appears to be emphasizing service on the 1100 series (with older lines suffering as a result); training is not very good."
 - "FEs need more training." (many)
 - "FEs need more knowledge of our applications and UNIVAC's software."

C. LONG-TERM STRATEGY

- The service industry's present problems have been identified in the foregoing chapters.
 - The integration of software service with hardware is progressing but has not been fully achieved; this is apparent to the users and requires major efforts on behalf of the vendor.
 - The integration of new product introductions with plans for FE training is not being accomplished adequately; a lot of the hands-on training is gained at the user's site.
- All vendors can improve by not finger pointing; users appreciate it when the vendor does not spend his time trying to apportion blame and instead gets on with solving the problem.
- In the user's eyes, the best improvement in field service has already occurred: decreased service needs because of increased hardware reliability. They would now like to see the same improvement in software.
- In preparation for that kind of service environment, a fundamental change in service product is needed: the package of services sold should be expanded to include all modes of after-sales support, the FE should become an assigned account-support representative, and the contractual package should be partially tailored to the particular user's needs. This tailoring can best be likened to that of the software world, where standard packaged applications are partially altered for installation at each site.
- Only in this way will the revenue stream from field services be protected and grow. Without careful consideration of these developments, vendors may find themselves caught in a spiral of decreasing revenues, loss cutting of operations, and decreasing quality of service. All could be hard to reverse.

APPENDIX A: DATA BASE FORMAT

APPENIDX A: DATA BASE FORMAT

A. DATA BASE OVERVIEW

- The user requirements data base is held at INPUT on Apple computers using the CP/M operating system.
- Data entry was accomplished using Ashton-Tate's dBASE II relational data base management system. The same system was used to create the raw data printouts already delivered.
- The data base for large- and medium-system users is contained in three raw data files and one numeric file created from quantifiable raw text data.
 - LSA.SDF 52K
 - LSB.SDF 56K
 - LSC.SDF 33K
 - LSD.SDF 23K
- Original dBASE file structures are also provided for clients who wish to restore the files to the dBASE format for analysis. The dBASE structures are stored on corresponding file names appended with the ".DBF" extension:

- LSA.DBF 1K
- LSB.DBF 1K
- LSC.DBF 1K
- LSD.DBF 1K

B. DESCRIPTION OF FILES

- Exhibits A-1 through A-4 list the field names of the four files as originally created under dBASE II.
 - These field names and parameters are contained in the four dBASE II structure files (LSA.DBF, LSB.DBF, etc.) for restoring data from the SDF format to dBASE II format.
 - Fields are easily recognizable by the corresponding question numbers and/or data cell descriptors in the questionnaire reproduced in Appendix B.
 - The listings contain additional information about the data type, maximum allowable characters in the field, and the number of decimal positions.
 - For example, in Exhibit A-1, the "Q2" field (number 18) is type "N" (numeric), is 7 characters wide (6 numerals and a decimal point), and contains 2 decimal positions.
 - A second example in Exhibit A-1 is the field "VENDOR" which contains alphanumeric characters (C) and has a maximum capacity of 20 characters (20).

EXHIBIT A-1

LSA. DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	Zip	C	005	
003	Industry	C	030	
004	Area	C	003	
005	Vendor	C	020	
006	Product	C	020	
007	Q1:A	N	002	
008	Q1:B	N	002	
009	Q1:C	N	002	
010	Q1:D	N	002	
011	Q1:E	N	002	
012	Q1:F	N	002	
013	Q1:G	N	002	
014	Q1:H	N	002	
015	Q1:I	N	002	
016	Q1:J	N	002	
017	Q1:K	N	002	
018	Q2	N	007	002
019	Q3	N	007	002
020	Q4	N	007	002
021	Q5:A:REQ	N	007	002
022	Q5:A:ACT	N	007	002
023	Q5:B:REQ	N	007	002
024	Q5:B:ACT	N	007	002
025	Q5:C:REQ	N	007	002
026	Q5:C:ACT	N	007	002
027	Q6:A	N	006	002
028	Q6:B	N	006	002
029	Q7	N	006	002

EXHIBIT A-2
LSB. DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	Q8:1:APP	C	031	
003	Q8:1:RATE	N	003	
004	Q8:2:APP	C	031	
005	Q8:2:RATE	N	003	
006	Q8:3:APP	C	031	
007	Q8:3:RATE	N	003	
008	Q9	N	003	
009	Q10:Q12	C	009	
010	Q13:Y:N	C	034	
011	Q13:A	N	005	001
012	Q13:B	N	005	001
013	Q13:C	N	005	001
014	Q13:D	N	005	001
015	Q13:E	N	005	001
016	Q13:F	N	005	001
017	Q13:G	N	005	001
018	Q13:H	N	005	001
019	Q13:I	N	005	001
020	Q13:J	N	005	001
021	Q17:A89	N	002	
022	Q17:A90	N	002	
023	Q17:A91	N	002	
024	Q17:A92	N	002	
025	Q17:A93	N	002	
026	Q17:A94	N	002	
027	Q17:A95	N	002	
028	Q17:A96	N	002	
029	Q17:A97	N	002	
030	Q17:A98	N	002	
031	Q17:A99	N	002	
032	Q17:A100	N	002	

EXHIBIT A-3

LSC. DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat :No	N	005	001
002	Q14:A62	N	002	
003	Q14:A63	N	002	
004	Q14:A64	N	002	
005	Q14:A65	N	002	
006	Q14:A66	N	002	
007	Q14:A67	N	002	
008	Q14:A68	N	002	
009	Q14:A69	N	002	
010	Q14:A70	N	002	
011	Q14:A71	N	002	
012	Q14:A72	N	002	
013	Q14:A73	N	002	
014	Q14:A74	N	002	
015	Q14:A75	N	002	
016	Q14:A76	N	002	
017	Q14:A77	N	002	
018	Q14:A78	N	002	
019	Q14:A79	N	002	
020	Q14:A80	N	002	
021	Q14:A81	N	002	
022	Q14:A82	N	002	
023	Q14:A83	N	002	
024	Q14:A84	N	002	
025	Q14:A85	N	002	
026	Q14:A86	N	002	
027	Q14:A87	N	002	
028	Q15	C	018	
029	Q16	C	015	
030	Q18	C	006	

EXHIBIT A-4

LSD. DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	C1	N	002	
003	C2	N	002	
004	C3	N	002	
005	C4	N	002	
006	C5	N	002	
007	C6	N	002	
008	C7	N	002	
009	C8	N	002	
010	C9	N	002	
011	C10	N	002	
012	C11	N	002	
013	C12	N	002	
014	C13	N	002	
015	B1	N	002	
016	B6	N	002	
017	B11	N	002	
018	B16	N	002	
019	B21	N	002	
020	B26	N	002	
021	B31	N	002	
022	B34	N	002	
023	B37	N	002	
024	B40	N	002	
025	B43	N	002	
026	B46	N	002	
027	B49	N	002	

- LSA is a raw data file containing demographic data (some of which has been removed to protect the users), vendor, product, and responses to questions 1 through 7.
- LSB is a raw data file containing responses to questions 8 through 13 and question 17. Raw data is contained in this file in the form of text for yes and no answers to certain questions; these text data are transformed later into numerical equivalents in LSD.
- LSC is a raw data file containing responses to questions 14 and 15 and question 18. As in LSB above, certain text data will be transformed into numerical equivalents in LSD as discussed below.
- LSD is a file created from certain raw text data in LSB and LSC substituting numerical ranges for responses:
 - Yes/no responses (C1-C13) are translated as follows:
 - No = -1
 - Yes = +1
 - No answer = 0
 - The text responses (check marks) to B1-B30 found in LSC become numeric data in LSD found in the related fields named B1, B6, . . . , B26 with the following translation:
 - Favor strongly = +2
 - Favor mildly = +1
 - Neutral = 0
 - Oppose mildly = -1
 - Oppose strongly = -2

- Similarly, the text responses from LSC in B31-B51 become numeric data in LSD fields B31, B34, . . ., B49 with three levels of translation:
 - . Favor = +1
 - . Neutral = 0
 - . Oppose = -1
- Linkage of the files is accomplished with the questionnaire catalog number (CAT:NO) field which is common in all four files for each respondent to the questionnaire.
 - Gaps in catalog number sequence are normal; the files have been completely edited for linkage consistency.
 - The "CAT:NO" field contains one decimal position to allow the insertion of late responses into the proper sequence.
 - The requirement of multiple files was imposed by constraints in dBASE II and the desirability of restoring the files to a popular CP/M-based data base management system.
- The following information is included for those wishing to restore files to dBASE II format:
 - The dBASE II files will require disk space as follows:
 - . LSA.DBF 74K
 - . LSB.DBF 72K
 - . LSC.DBF 32K
 - . LSD.DBF 19K
 - Assume that a blank formatted disk is in CP/M drive C:, and the original LSA files are in drive B: and you wish to restore LSA to dBASE II format.

- Call dBASE in Drive A:.
- Issue the following dBASE commands:
 - . USE B: LSA
 - . COPY TO C:LSA STRUCTURE
 - . USE C:LSA
 - . APPEND FROM B:LSA.SDF DELIMITED

APPENDIX B: USER QUESTIONNAIRE

User Interview Profile (R/A check proper row items.)VENDOR* PRODUCT

IBM _____ 308X _____ 43XX _____ 303X _____

Burroughs _____ B5900 _____ B6900 _____

Honeywell _____ DPS7 _____ DPS8 _____ 66DPS _____ 68DPS _____

Univac _____ 90/60 _____ 90/80 _____ 1100/80 _____ 1100/90 _____

CDC _____ Omega/480 _____ Cyber 170/800 _____ Cyber 170/700 _____

Cray _____ Cray-1 _____

Tandem _____ Nonstop _____ Nonstop II _____

DEC _____ DEC-10 _____ DEC-20 _____ VAX-11/780 _____

Amdahl _____ 470 series _____ 58XX series _____

Data General _____ Eclipse MV/6000 _____

NAS _____ AS/5000 series _____ AS/7000 series _____ AS/9000 _____

Perkin Elmer _____ Sixteen 10 _____ Sixteen 20 _____ Sixteen 30 _____

*DATA ENTRY: Enter only one vendor and one product per questionnaire.

1. On a scale of 1-10, please rate _____ (vendor)
in the following categories:

	(1-10)
a) Service management communication	_____ (A1)
b) Hardware service engineer's communication	_____ (A2)
c) Software service engineer's communication	_____ (A3)
d) Ability to diagnose problems in hardware and to make quality repairs	_____ (A4)
e) Ability to maintain software	_____ (A5)
f) General responsiveness of the vendor organization	_____ (A6)
g) Overall service image	_____ (A7)
h) Taking the initiative to improve user operations	_____ (A8)
i) Resolution of invoicing disputes	_____ (A9)
j) Dispatching trouble calls	_____ (A10)
k) Escalation of extended downtime	_____ (A11)

Comments: _____

2. How long does it normally require _____ to repair your equipment? _____ hours. (R/A, fill in vendor name.)
(R1)
3. What is your requirement for hardware service response time?
_____ hours.
(R2)
4. What is the average time it takes _____ (vendor to) respond? _____ hours. (R/A, fill in vendor.)
(R3)
5. The following questions relate to software maintenance response time, i.e., the time required to have software maintenance person dedicated to resolution.

	Required (hours)	Actual Average (hours)
a) Response time of software engineer when system is inoperable	_____ (R4)	_____ (R5)
b) Response time when system is significantly degraded	_____ (R6)	_____ (R7)
c) Response time when problem is circumvented with mild degradation	_____ (R8)	_____ (R9)

6. a) What overall level of availability do you require of your equipment? (Availability is defined as the ratio of scheduled usage divided by the sum of scheduled time plus downtime plus recovery time.) _____ %
(R10)
- b) What level availability are you experiencing? _____
(R11)
7. What level of availability do you require of your equipment during your most critical periods? _____ %
(R12)

8. a) Please rank the 3 most critical applications using your _____
_____ equipment with 1 being most critical (R/A, fill in
appropriate vendor designation in blank space).
- b) On a scale of 1-10, with 10 representing critical to the survival
of your business, how critical does downtime become during the
following applications?

Applications	(a) Rank	(b) Rate
Order Entry/Accounts Receivable	_____ (A12)	_____ (A13)
Purchasing/Accounts Payable	_____ (A14)	_____ (A15)
General Ledger Accounting	_____ (A16)	_____ (A17)
Payroll	_____ (A18)	_____ (A19)
Materials/Inventory Controls	_____ (A20)	_____ (A21)
Cost Accounting	_____ (A22)	_____ (A23)
Engineering, Design/CAD	_____ (A24)	_____ (A25)
Process Control/CAM	_____ (A26)	_____ (A27)
PERT/CPM	_____ (A28)	_____ (A29)
Time Sharing	_____ (A30)	_____ (A31)
Reservations	_____ (A32)	_____ (A33)
Scientific Analysis	_____ (A34)	_____ (A35)
Business Modelling	_____ (A36)	_____ (A37)
Business Graphics	_____ (A38)	_____ (A39)
Transaction Control	_____ (A40)	_____ (A41)
Other _____	_____ (A42)	_____ (A43)

9. On a scale of 1-10, how important is a single source of maintenance to you? (1 = no importance, 5 = worth serious consideration, 10 = absolutely necessary) _____
(A51)
10. Do you employ third-party maintenance for any of your equipment?
Yes/No _____
(C1)
11. Have you considered third-party maintenance as a single source?
Yes/No _____
(C2)
12. Would you consider a maintenance management contract as an alternative to a single source or third-party? The management contract would provide you with a single interface to all vendors. Yes/No _____
(C3)

* DATA ENTRY: Questions 10-12 are single character entries, either "Y," or "N," or nothing.

13. Do you have a requirement for any of the following services, and if so, what would you consider a reasonable premium to pay over the basic maintenance charge?

Service	* Yes / No	Reasonable Premium (percent)
a) Stand-by coverage during critical periods	<u> </u> (C4)	<u> </u> % (A52)
b) Guaranteed uptime	<u> </u> (C5)	<u> </u> % (A53)
c) Guaranteed response time	<u> </u> (C6)	<u> </u> % (A54)
d) On-site spare parts	<u> </u> (C7)	<u> </u> % (A55)
e) Remote diagnostics	<u> </u> (C8)	<u> </u> % (A56)
f) Preventive maintenance and field changes during off-prime hours	<u> </u> (C9)	<u> </u> % (A57)
g) Occasional shift coverage (versus fixed schedule)	<u> </u> (C10)	<u> </u> % (A58)
h) Full-time, on-site service engineer	<u> </u> (C11)	<u> </u> % (A59)
i) Guaranteed repair time (hardware)	<u> </u> (C12)	<u> </u> % (A60)
j) Guaranteed turnaround on software fixes	<u> </u> (C13)	<u> </u> % (A61)

* DATA ENTRY: For "Yes/No" column see note on preceding page.

14. a) Please rate, on a scale of 1-10, your requirements for the following vendor goods and services.
- b) Please rate your current level of satisfaction with the goods and services you receive from your equipment and/or maintenance vendor.

Vendor Goods and Services	Scale 1-10	
	Requirement (a)	Current Level (b)
Environmental Planning	_____ (A62)	_____ (A63)
Physical Site Planning	_____ (A64)	_____ (A65)
Consulting	_____ (A66)	_____ (A67)
Documentation	_____ (A68)	_____ (A69)
Training	_____ (A70)	_____ (A71)
Installation Planning	_____ (A72)	_____ (A73)
Hardware Maintenance	_____ (A74)	_____ (A75)
Software Maintenance	_____ (A76)	_____ (A77)
Supplies Sales	_____ (A78)	_____ (A79)
Add-on Sales	_____ (A80)	_____ (A81)
Site Audits	_____ (A82)	_____ (A83)
Relocation	_____ (A84)	_____ (A85)
De-installation	_____ (A86)	_____ (A87)

- 15) Would you favor or oppose having the field service engineer in a sales role for the following:

	Favor		Neutral	Oppose	
	Strongly	Mildly		Mildly	Strongly
Supplies	<u> </u> (B1)	<u> </u> (B2)	<u> </u> (B3)	<u> </u> (B4)	<u> </u> (B5)
Hardware features	<u> </u> (B6)	<u> </u> (B7)	<u> </u> (B8)	<u> </u> (B9)	<u> </u> (B10)
Add-on equipment	<u> </u> (B11)	<u> </u> (B12)	<u> </u> (B13)	<u> </u> (B14)	<u> </u> (B15)
New models of equipment	<u> </u> (B16)	<u> </u> (B17)	<u> </u> (B18)	<u> </u> (B19)	<u> </u> (B20)
Upgrades	<u> </u> (B21)	<u> </u> (B22)	<u> </u> (B23)	<u> </u> (B24)	<u> </u> (B25)
Software packages	<u> </u> (B26)	<u> </u> (B27)	<u> </u> (B28)	<u> </u> (B29)	<u> </u> (B30)

16. Regarding your maintenance contracts, which of the following provisions do you favor or oppose?

	Favor	Neutral	Oppose
Long-term contracts > 1 year	<u> </u> (B31)	<u> </u> (B32)	<u> </u> (B33)
Automatic renewal	<u> </u> (B34)	<u> </u> (B35)	<u> </u> (B36)
Variable shift coverage	<u> </u> (B37)	<u> </u> (B38)	<u> </u> (B39)
Standardized forms (versus negotiated contracts)	<u> </u> (B40)	<u> </u> (B41)	<u> </u> (B42)
Annual invoicing	<u> </u> (B43)	<u> </u> (B44)	<u> </u> (B45)

17. Assuming appropriate discounts or premiums as applicable, please rate the relative importance of receiving your hardware and software maintenance by the following methods: (scale 1-10)

	(1-10)	
	Hardware	Software
Traditional, on-site response to trouble calls	<u> </u> (A89)	<u> </u> (A90)
Your involvement in diagnosis working with support center without remote diagnostics	<u> </u> (A91)	<u> </u> (A92)
Your involvement in diagnosis with remote diagnostics	<u> </u> (A93)	<u> </u> (A94)
Your involvement replacing circuit boards, other components, or patching software	<u> </u> (A95)	<u> </u> (A96)
Delivering portable modules to repair centers	<u> </u> (A97)	<u> </u> (A98)
On-site stand-by of service personnel during critical periods.	<u> </u> (A99)	<u> </u> (A100)

18. Do you favor or oppose the unbundling of maintenance requirements?

	Favor	Neutral	Oppose
Hardware	<u> </u> (B46)	<u> </u> (B47)	<u> </u> (B48)
Software	<u> </u> (B49)	<u> </u> (B50)	<u> </u> (B51)

19. In your opinion, what changes should _____
(vendor) make to significantly improve the level of service?

20. Are the improvements needed generally throughout field service or
just at _____(vendor)?

Comments: _____

APPENDIX C: RESPONDENT USERS

APPENDIX C: RESPONDENT USERS

- A. G. EDWARDS & SONS
- ABBOT LABORATORIES, INC.
- ADVEST
- ALABAMA STATE UNIVERSITY
- ALBUQUERQUE PUBLIC SCHOOLS
- ALLIS CHALMERS - PLANT #2
- AMBASSADOR COLLEGE
- AMERICAN AIRLINES
- AMERICAN EXPRESS
- AMERICAN HOIST & DERRICK
- APPLIANCE BUYERS CREDIT
- ARCO
- ARIZONA CRIMINAL INTELLIGENCE
- ARKANSAS COMPUTER SERVICES
- ATMOSPHERIC DEPARTMENT
- AUTEX
- BADDOUR, INC.
- BALTIMORE GAS & ELECTRIC
- BANCTEC, INC.
- BELL SYSTEMS CENTER
- BENDIX CORPORATION-WARNER SWASEY COMPANY
- BLUE CROSS OF ARIZONA
- BMA DATA PROCESSING, INC.
- BOCES II

- BOEING COMPUTER SERVICE
- BOSLER SUPPLY
- BOSTON & MAINE RAILROAD
- BROADVIEW SAVINGS & LOAN
- BUCKLEY DEMENT ADVERTISING
- BUREAU OF NATIONAL AFFAIRS
- BURNS & MCDONNELL
- CALGON CORPORATION
- CALIFORNIA DEPARTMENT OF MOTOR VEHICLES
- CALIFORNIA DEPARTMENT OF JUSTICE
- CAROLINA STEEL CORPORATION
- CATERPILLAR TRACTOR COMPANY
- CATHOLIC UNIVERSITY OF AMERICA
- CEDAR SINAI MEDICAL CENTER
- CENTRAL LABS OF MARYLAND
- CHARLESTON COUNTY DP CENTER
- CHARTER DATA SERVICES
- CHARTER MEDICAL CORPORATION
- CHATHAM SUPER MARKETS
- CHESSIE SYSTEMS
- CHILDRENS HOSPITAL
- CITIZENS SAVINGS & LOAN
- CITY OF AKRON
- CITY OF BIRMINGHAM
- CITY OF COSTA MESA
- CITY OF INGLEWOOD
- CITY OF LUBBOCK
- CITY OF PASADENA
- CITY OF PITTSBURGH
- CITY OF PORTLAND
- CITY OF TALLAHASSEE
- CLAIRMONT TRANSFER COMPANY
- CMS COMPANIES INC.

- COAST COMMUNITY COLLEGE
- COLE NATIONAL GROUP
- COLORADO STATE UNIVERSITY
- COMBUSTION ENGINEERING
- COMPUTER APPLICATIONS SERVICE CORPORATION
- COMPUTER GRAPHICS
- COMPUTER INDUSTRIES CORPORATION
- COMPUTER USAGE COMPANY
- CONCORD GENERAL MUTUAL INSURANCE
- CONOCO, INC.
- CONSUMERS POWER COMPANY
- CONTINENTAL MOTORS
- CONTROL & SOUTHWEST CORPORATION
- COOPER TIRE & RUBBER COMPANY
- CORPORATE SYSTEMS
- COTTON STATES MUTUAL
- CTB MCGRAW HILL
- CUBIC CORPORATION
- DALLAS COUNTY DATA CENTER
- DATA PROCESSING OF THE SOUTH
- DATACOMP CORPORATION
- DAVID CRYSTAL, INC.
- DAYTON POWER & LIGHT
- DIGITAL PRODUCTIONS
- DRILLING INFORMATION SERVICE COMPANY
- DUCOMMUN, INC.
- EAST STROUNDSBERG STATE COLLEGE
- EASTERN ASSOCIATED COAL COMPANY
- EDDIE BAUER, INC.
- EDMUNDS & ASSOCIATES
- EDS NUCLEAR
- ELECTRIC MUTUAL LIABILITY INSURANCE
- ELMHURST MEMORIAL HOSPITAL

- ENERGY ENTERPRISES OF DENVER
- EQUITABLE OF IOWA
- ESE, INC.
- F.A. DAVIS & SON
- FARM BUREAU INSURANCE
- FASTAX
- FBI
- FEDERAL HOME LOAN BANK
- FINANCIAL DATA SYSTEMS
- FIRST FEDERAL SAVINGS & LOAN
- FIRST NATIONAL BANK OF BOSTON
- FIRST NATIONAL BANK OF DENVER
- FLEET DATA SERVICES
- FLORIDA STATE UNIVERSITY
- GAS SERVICE COMPANY
- GELCO CORPORATION
- GEORGIA STATE UNIVERSITY
- GIFFORD HILL & COMPANY, INC.
- GINO'S INN
- GLENDALE COMMUNITY COLLEGE
- GOVERNMENT EMPLOYEES INSURANCE COMPANY
- GRIT PUBLISHING
- GUARANTY NATIONAL INSURANCE
- GULF OIL
- HAMILTON/AVNET
- HAMMOND ELECTRONICS
- HARRIS COUNTY CLERK
- HARRIS COUNTY TAX OFFICE
- HARRY & DAVID
- HAZELHURST & ASSOCIATES
- HBO
- HEALTH EXAMINERS
- HEBREW NATIONAL

- HERCULES
- HON COMPANY
- HOUSTON BELT & TERMINAL RAILROAD
- HUGHES AIRCRAFT
- HUMBOLDT STATE UNIVERSITY
- ILLINOIS DEPARTMENT OF REVENUE
- ILLINOIS STATE UNIVERSITY
- INFORMATICS
- INFORMATION DYNAMICS
- INSTITUTE OF PAPER CHEMISTRY
- INTERACTIVE DATA CORPORATION
- INTERRA
- INTRAWEEST BANK OF DENVER
- JACKSON NATIONAL LIFE INSURANCE
- JACKSONVILLE MEMORIAL HOSPITAL
- JACOBSEN & ASSOCIATES
- JAVELL COMPANIES
- KINDER-CARE LEARNING CENTER
- KREAGE HEARING RESEARCH
- KROGER
- LAWRENCE LIVERMORE LABS
- LEXINGTON COUNTY HOSPITAL
- LIBRARY OF CONGRESS
- LIFE INSURANCE COMPANY OF GEORGIA
- LONG BEACH CITY COLLEGE
- LONG ISLAND CITY SAVINGS BANK
- LOS ALAMOS NATIONAL LAB
- LUBRIZOL CORPORATION
- LUTHERAN MEDICAL CENTER
- MALONE FREIGHT LINES
- MANAGEMENT DECISION SYSTEMS
- MANAGISTICS, INC.
- MARICOPA COUNTY EDUCATION DEPARTMENT

- MARICOPA COUNTY HIGHWAY DEPARTMENT
- MARY BALDWIN COLLEGE
- MASSACHUSETTS INSTITUTE OF TECHNOLOGY
- MAY COMPANY
- MCNEAL PHARMACEUTICAL
- MEAD DIGITAL SYSTEMS
- MEGATEK
- MICHIGAN CONSOLIDATED GAS
- MID CONTINENT SYSTEMS, INC.
- MID IOWA EDUCATIONAL FACILITY
- MID TERM STATE UNIVERSITY
- MILES LABORATORIES, INC.
- MISSISSIPPI EMPLOYMENT SECURITY
- MOBILE INFIRMARY
- NEW HAMPSHIRE DEPARTMENT OF PUBLIC WORKS
- NAKO CHEMICAL COMPANY
- NASHVILLE GAS COMPANY
- NATIONAL INFORMATION SYSTEMS
- NATIONAL SERVICE INDUSTRIES
- NATIONAL CENTER FOR ATMOSPHERIC RESEARCH
- NAVCO CORPORATION
- NEWMONT SERVICES, LTD.
- NORTH TEXAS STATE UNIVERSITY
- NORTHEAST REGIONAL DATA
- NORTHERN ILLINOIS UNIVERSITY
- NORTHWEST FEDERAL SAVINGS
- NORTHWEST ORIENT AIRLINES
- NORTHWEST PIPELINE
- NORTHWESTERN UNIVERSITY
- OKLAHOMA EMPLOYMENT COMMISSION
- OLYMPIA BREWING COMPANY
- PABST BREWING COMPANY
- PACIFIC SOUTHWEST AIRLINES

- PACIFIC TELEPHONE
- PATTERSON DENTAL COMPANY
- PEABODY COAL COMPANY
- PENNSYLVANIA STATE UNIVERSITY
- PENSACOLA JUNIOR COLLEGE
- PETERSON HOWELL & HEATHER
- PETROLEUM DATA CORPORATION
- PHILADELPHIA ELECTRIC
- PHILIP MORRIS, INC.
- PLANNING RESEARCH CORPORATION
- PORTLAND PUBLIC SCHOOLS
- PRODUCERS COTTON OIL COMPANY
- PUBLIC SERVICE OF INDIANA
- R. J. REYNOLDS COMPANY
- RE/SPEC
- REILLY TAR & CHEMICAL CORPORATION
- RICE UNIVERSITY
- RICH PRODUCTS CORPORATION
- RIVERSIDE COUNTY
- ROCHESTER TELEPHONE CORPORATION
- ROUGE STEEL COMPANY
- RUBBERMAID, INC.
- SAGA CORPORATION
- SAN ANTONIO PUBLIC SERVICE BOARD
- SAN DIEGO STATE UNIVERSITY
- SAN FRANCISCO STATE UNIVERSITY
- SAN JOSE STATE UNIVERSITY
- SANDIA LABS
- SCIENCE APPLICATIONS
- SEAL OFFICE SUPPLY
- SECURITY LIFE
- SINGER COMPANY
- SOUTH CENTRAL BELL

- SOUTHERN BELL
- SOUTHERN DATA SERVICES
- SOUTHWESTERN BELL
- ST. JOHNS UNIVERSITY
- STANDARD OIL OF OHIO
- STRAUS-FRANK COMPANY
- SUPERMARKETS GENERAL CORPORATION
- TEKTRONIX, INC.
- TEXAS EASTERN TRANSMISSION
- TEXAS EDUCATIONAL FOUNDATION
- TEXAS ELECTRIC COOPERATIVE
- TEXAS GAS TRANSMISSION
- TEXAS INDUSTRIES
- THOMAS NELSON, INC.
- TIME, INC.
- TIMESHARING CONSULTANTS
- TRIANGLE INFORMATION SYSTEMS
- TROY STATE UNIVERSITY
- TTI
- TUFTS UNIVERSITY
- TV GUIDE
- TYSON FOODS
- U.S. BANKCORP INFORMATION SERVICE
- U.S. DEPARTMENT OF ENERGY
- UCLA HOSPITAL
- UNION SCIENCE & TECHNOLOGY
- UNION TEXAS PETROLEUM
- UNITED BANK OF DENVER
- UNITED INFORMATION SYSTEMS
- UNITED TELEPHONE OF OHIO
- UNITED TRANSPORTS, INC.
- UNIVERSITY OF ARIZONA
- UNIVERSITY OF ARKANSAS

- UNIVERSITY OF COLORADO
- UNIVERSITY OF GEORGIA
- UNIVERSITY OF LOWELL
- UNIVERSITY OF MONTANA
- UNIVERSITY OF NEW HAVEN
- UNIVERSITY OF SAN FRANCISCO
- UNIVERSITY OF WASHINGTON
- U.S. DEFENSE PERSONNEL
- VALLEY BANK OF NEVADA
- VEEDER-ROOT COMPANY
- WEBER COUNTY GOVERNMENT
- WELEX
- WEST GEORGIA COLLEGE
- WESTERN NEW ENGLAND COLLEGE
- WESTINGHOUSE ELECTRIC
- WILLIAMS COMPANIES
- WINSTON SALEM CITY HALL
- WORCESTER POLYTECHNIC
- WR GRACE & COMPANY
- XEROX CORPORATION
- YALE UNIVERSITY
- YEARBOOK MEDICAL BOOK

